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Contents 37. Advertising Index 67

"Vulcan" "C" Clamps

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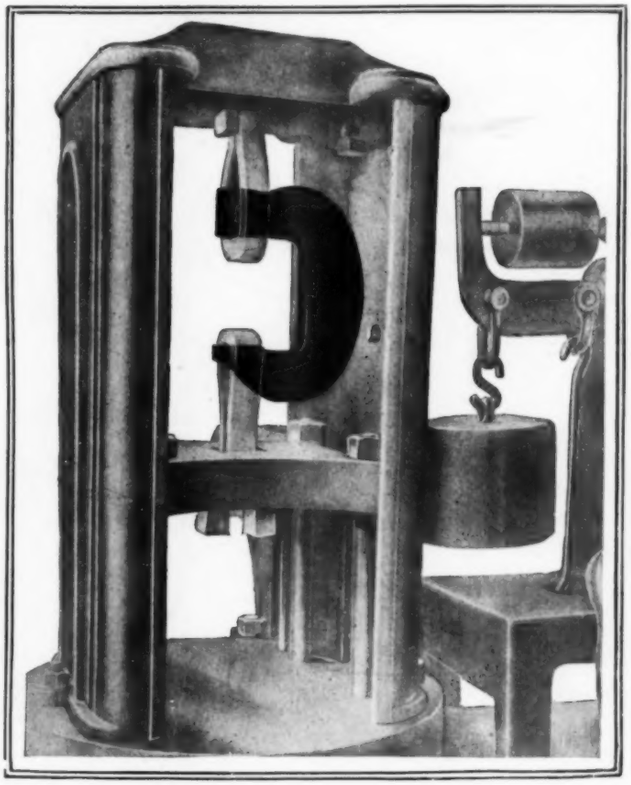

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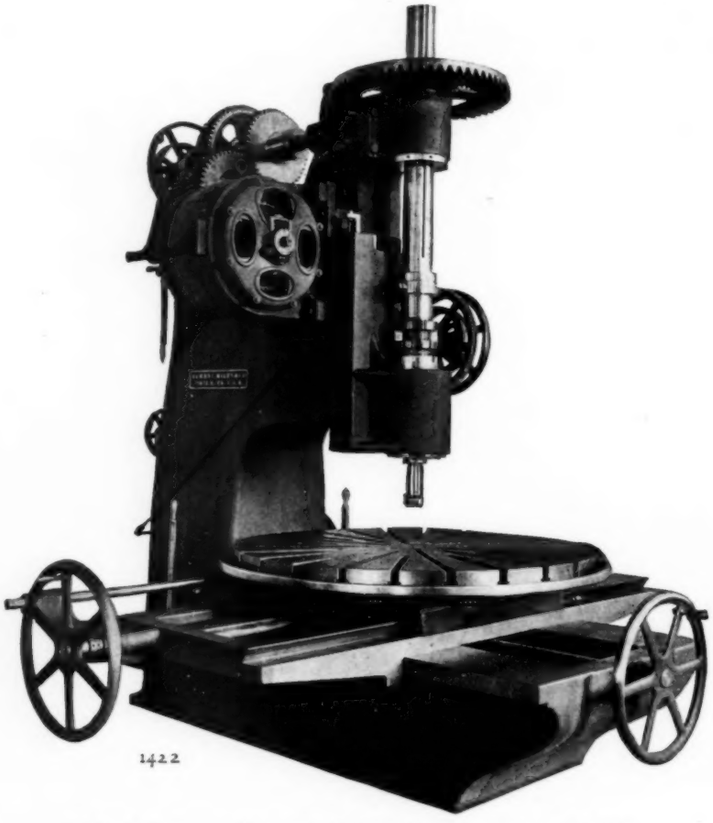

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(*See pages* 59, 60, 61, 62 *and* 63)

Tools in a Sewing Machine Plant

By F. A. Stanley *

Special machines and fixtures used extensively in a plant manufacturing nearly a half million sewing machines annually. These tools, in most cases designed and built in the works, constitute effective equipment for economical production.

Millers of various types, slot-cutting apparatus, drillers and reaming machines, a broaching tool and a machine for finishing cams.

*Western editor.

The Davis Sewing Machine Company, of Dayton, O., uses in that branch of manufacture from which it derives its name, a large number of special machines and tools, most of which were designed and built by the company itself to suit the peculiar requirements of the sewing-machine industry. Several of these machines and methods are illustrated by the accompanying halftone and line engravings, and some further views of special equipment and operations will be presented in another article.

As was the case with the bicycle department of this concern illustrated in an earlier issue of this journal, it is difficult with so many methods of interest in use, to select just those best adapted to indicate the general procedure of the factory and at the same time keep within the desired limits of space for an article of this character. So, at best, this description can only touch what we commonly refer to as the "high spots," leaving undisturbed for the present, at least, a considerable number of important machines, special tools and methods, all of which would be of value to readers were it possible to include an account of them within the limitations of this article.

Output, Methods of Handling, Etc.

The plant produces over twelve hundred sewing machines of different models daily, and the visitor walking through the various departments cannot fail to be impressed with the rapidity with which the numerous operations necessary are performed in the machining and assembling of the parts. The quantities of machines progressing through the factory simultaneously, are brought to one's notice particularly in such departments as that in Fig. 1, which represents a hundred sewing machines on a "running-off jack" where the shafts are driven at high speed for a half hour to run them down to good bearings. At the rear of the machines on the jack will be seen a number of trucks which are used in the different departments and which enable hundreds of sewing machines to be handled daily about the shop.

This view has been selected for Fig. 1, as it is fairly typical of a number of departments in the factory. The illustrations that follow represent several special machines which are only a few of scores of efficient tools in constant service in this establishment.

A "Right Angle" Miller

The miller in Fig. 2 simultaneously faces the bottom of the sewing-machine arm and the vertical surface at the end of the arm which receives the faceplate for inclosing the needle bar and the presser bar. These two surfaces are at right angles to each other and the machine in Fig. 2 is equipped with two spindles similarly located in relation to one another. The work is placed in a fixture which holds it securely while the cutters are at work, the diagram in Fig. 3 indicating the position of work and cutters when viewed from above.

The position of the spindle head at the rear of the machine is fixed in relation to the bed, but the head at the left is adapted to slide crosswise upon the carriage on which the work itself is mounted. This construction is shown clearly in Fig. 2. The object of this design is to permit the entire carriage with one cutter and the work to feed past the cutter at the rear and at the same time allow the cutter on the carriage to feed transversely past the corresponding face of the work.

The work rests upon suitable supports in the base of the holding fixture, and quick-acting clamps are provided for securing the casting in place. The work is not shown in the fixture as a better view of the cutters and fixture is obtained with the sewing-machine arm removed The spindle drives are by separate belts and another belt leading down from the spindle at the rear operates the feed for the carriage and for its cross slide. The feed screws are actuated through worm gearing and automatic stops are provided for releasing the feed at the end of the cut. The dogs and lever for controlling the longitudinal travel will be noticed at the front of the machine bed.

Drilling and Reaming Machines

Figs. 4 and 5 illustrate double-end machines for drilling and reaming bearings for main shafts in sewing-machine arms. The casting is held as in Fig. 6, by resting upon a knife-edge support under the

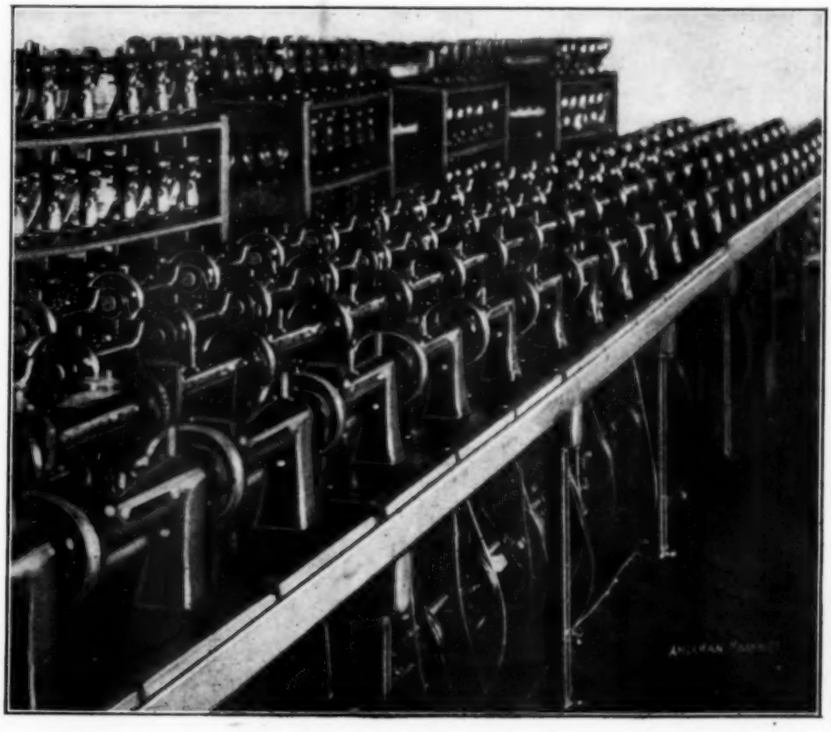


Fig. 1. Jacks for "Running In" Main Shafts in Sewing Machines

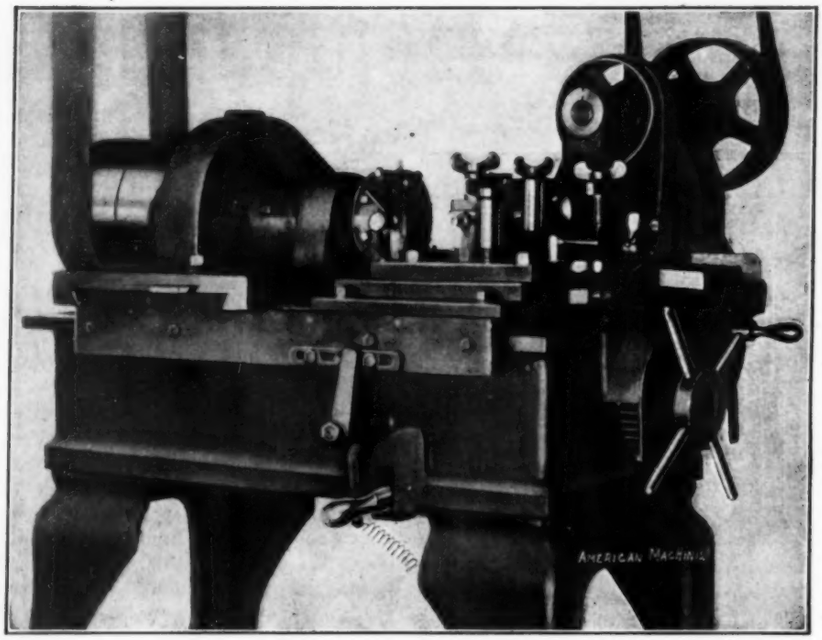


FIG. 2. MACHINE FOR MILLING ENDS AND BOTTOMS OF SEWING MACHINE ARMS

base, and upon an elevated ledge at the other end. Two stop screws are provided in lugs at one end and one stop at the other, to position the arm sidewise, and the nurled-head screw tapped through the upright at one end of the holding fixture presses the work endwise with its finished face against the opposite upright, as in Fig. 6.

Separate machines are used for drilling and reaming, but essentially the construction is the same in both groups of machines. The drills or reamers are guided by long bushings and are operated by spindles which are belt driven independently, and which are moved endwise to feed the tools into the work, by means of vertical levers actuated from cams on the horizontal shaft extending the length of the bed. This shaft is driven by worm and worm wheel, the worm shaft having a separate belt drive from overhead, as represented in Fig. 4.

Upon the completion of the forward movement of the spindles, the cam allows them to be returned by spring action and then automatically releases a weight which throws the power movement out of service until the work is removed, another casting put in place, and the automatic feed again engaged by operation of the foot lever.

The holding fixtures on the two classes of machines are exact duplicates of each other, and the stops are so fixed that the cast-iron arm with its holes drilled for the shaft may be placed in the reaming fixture with the assurance that the drilled holes will come in alinement with the guide bushings for the reamers.

AUTOMATIC SLOT MILLER

The machine in Figs. 7 and 8 is an automatic miller for cutting a straight slot for a cam lever through the wall of the needle-bar chamber at the end of

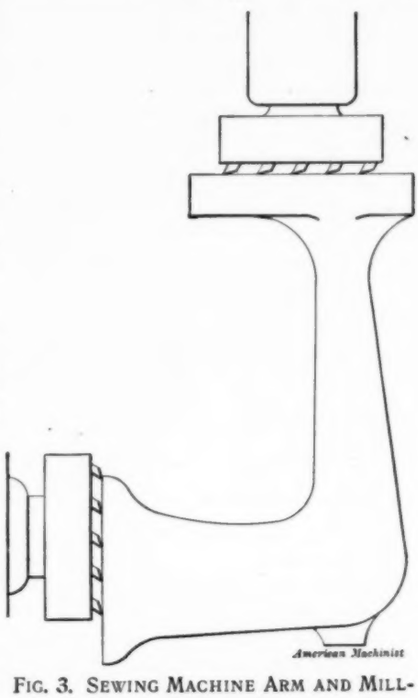


FIG. 3. SEWING MACHINE ARM AND MILLING CUTTERS

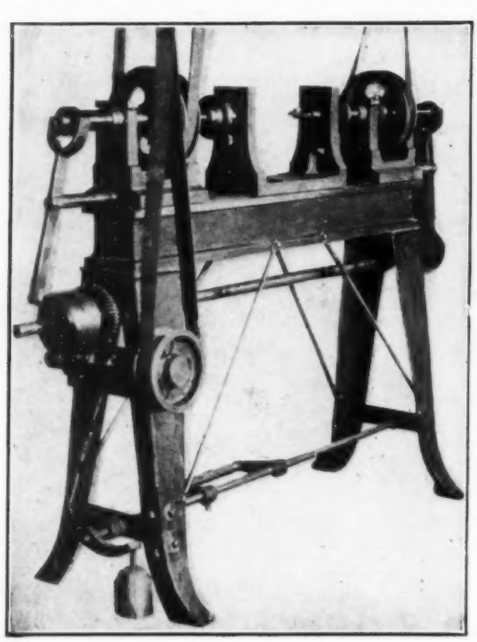


FIG. 4

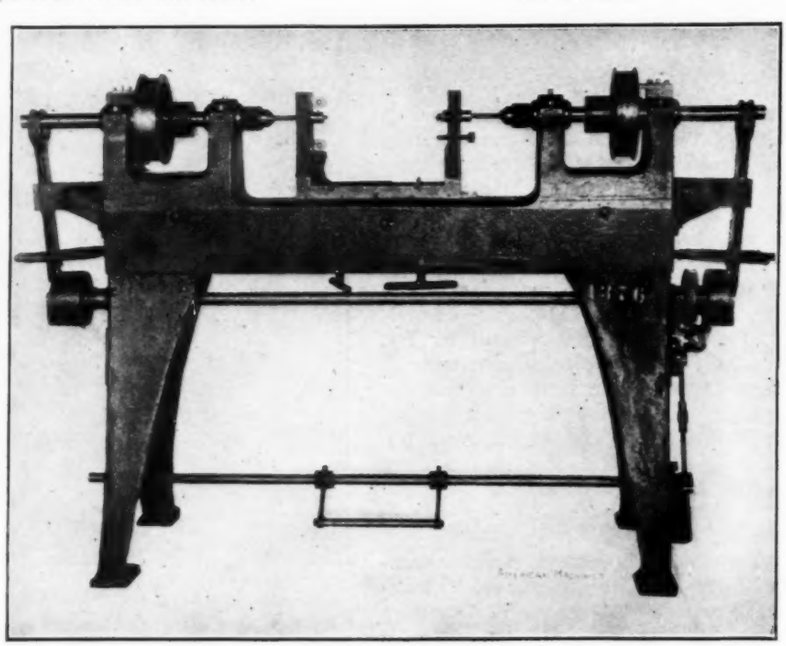


FIG. 5

AUTOMATIC DRILLING AND REAMING MACHINES FOR SEWING MACHINE ARMS

the sewing-machine arm. This slot is shown in the sketch, Fig. 8, with the shank mill in position for taking the cut.

Referring to Fig. 7, it will be noticed that the table of the miller has a longitudinal movement imparted by cam action, the operating cam *A* being one of a pair placed side by side upon the horizontal shaft which is driven through universal joints from the worm wheel and worm at the rear. After the forward movement of the table has taken place the return is secured by the heavy weight suspended by a chain as indicated.

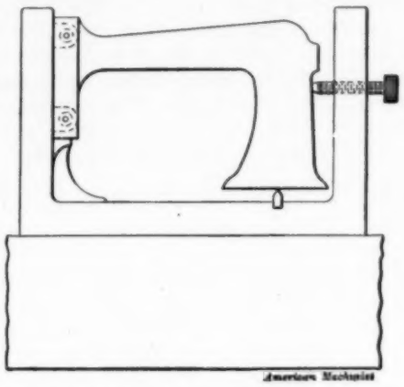


FIG. 6. SEWING-MACHINE ARM IN POSITION FOR DRILLING AND REAMING

The cam *B* performs the operation of lifting the swinging fixture *C* with the work to start the cut at one end of the slot. The work is shown in place in the sketch, Fig. 8, but in order to bring out the nature of the fixture and the supporting plugs the photograph, Fig. 7, was taken with the work removed. This view shows clearly how the sewing-machine arm is mounted upon three plugs, one of which is fixed in the upright at *D*, while at *E* and *F* are two sliding plugs with nurled handles which are slipped into the top hole for the needle bar in the sewing-machine arm, and into the rear hole for the main shaft. In this way the arm is supported square with the cutter spindle and after it is so located by sliding in the plugs *E* and *F*, jack screws are brought up underneath the casting to further stiffen it against the cutter action and prevent vibration.

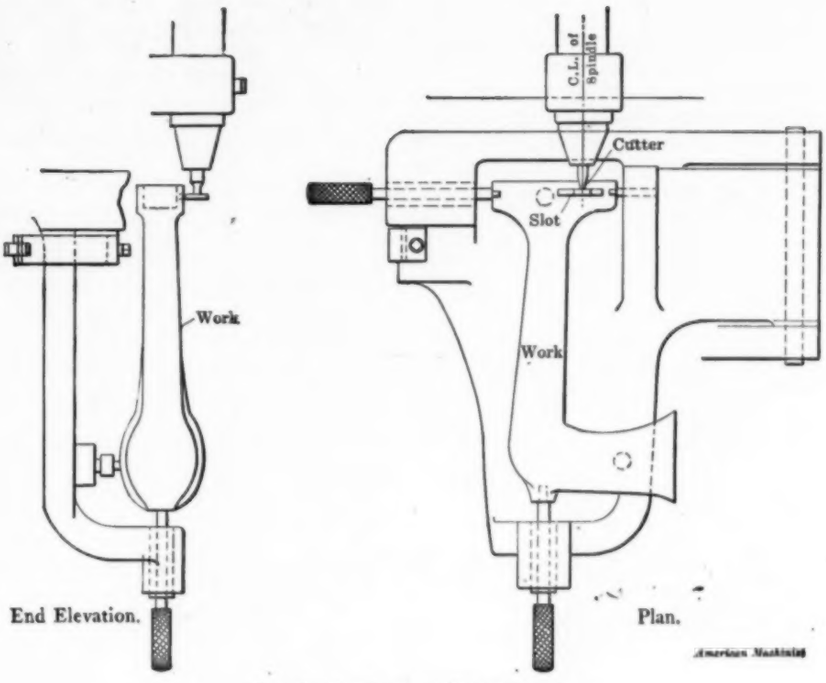


FIG. 8. AUTOMATIC SLOT-MILLER

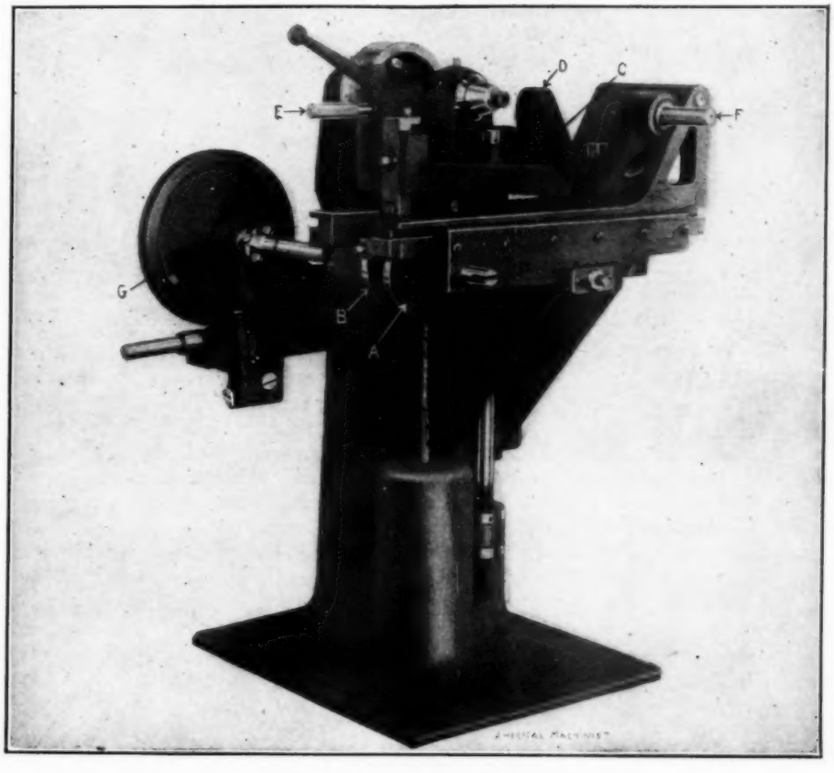


FIG. 7. AUTOMATIC SLOT-MILLER

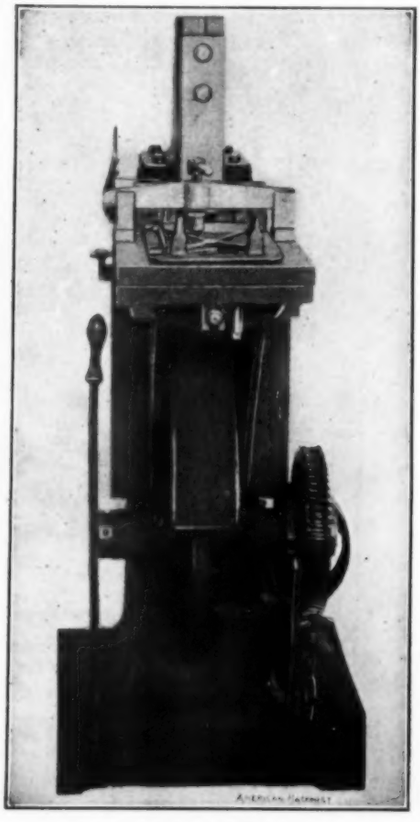


FIG. 9. A BROACHING MACHINE

Operation of the Machine

With the sewing-machine arm in place, the operator lifts the driving worm into engagement with the worm wheel and cam *B* at once elevates the fixture *C* with the work until the cutter has passed through the wall of the casting. The cam *A* then starts the longitudinal travel

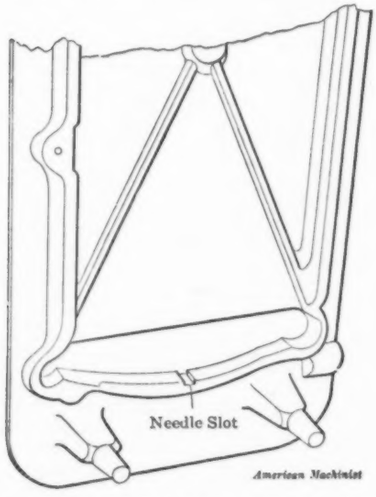


Fig. 10. Under Side of Sewing Machine Bed Plate Showing Needle Slot

of the miller table and the slot is cut straight for the predetermined distance, when cam *B* allows the fixture *C* to drop away from the cutter, thus clearing the work and permitting the table to be returned by the weight to its original position. The sewing-machine arm may then be removed and another casting placed on the plugs in the swinging fixture.

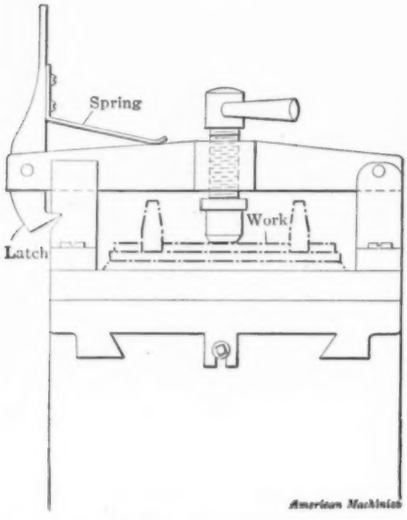


Fig. 11. Method of Holding Bed Plate on Broaching Machine

It should be noted that the worm wheel for driving the feed-cam shaft has on its inner face a dog *G* which is adapted to contact with the supporting latch of the worm upon completion of the cycle of movements and thus automatically drop the worm and stop the feed. It takes but a moment to remove the slotted casting, place another one in the fixture and lift the feed worm into action.

A Broaching Machine

The broaching machine in Fig. 9 was designed especially for cutting the needle slot in bedplates. One of these plates is represented in position on the table of the machine, but the shape and position of the broached opening is best seen in the sketch, Fig. 10.

The ram with the broaching tool is actuated from the cam shaft at the bottom of the column and the worm gearing by which the shaft is driven is controlled by the vertical hand lever at the left (which throws the worm gear into action) and by an automatic trip at the side of the worm wheel which releases the drive upon the completion of the stroke.

The sewing-machine bedplate to be operated upon is held on the table of the machine by means of a clamp screw turned by a handle and fitted in a pivoted

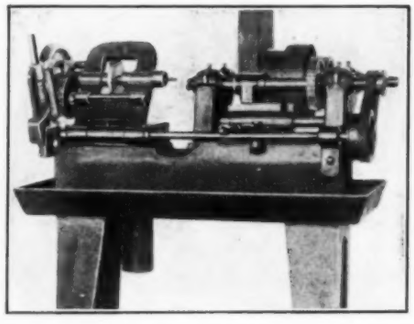


Fig. 12. Cam-miller

bar, as shown in Fig. 11. The bar is adapted to swing down across the work and is locked in the position represented, by a latch which is held by a spring in engagement with a notch in the face of an upright on the table. This arrangement enables the operator to clamp or release the casting by swinging the gate up or down and merely giving the clamp screw a part of a turn.

A Cam Miller

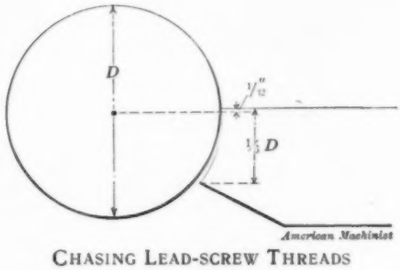
The machine illustrated by Fig. 12 is a miller for machining certain small cams used in sewing-machine construction. The cams are first machined in the bore and faced and are then ready to be slipped on the arbor in the work spindle of this machine. The head for the work is shown to the left, while the cutter head is on the right. The cutter spindle is geared to the cone-pulley shafts and is adjustable longitudinally by a lever in front to position the cutter endwise in correct relation to the work. The work spindle is actuated by worm gearing which is driven by bevel gears through the medium of the horizontal shaft shown belted from the cutter spindle.

The work spindle is fitted with a master cam which bears upon a guide roll and causes the head and the revolving work blank to rise and fall in relation to the milling cutter. At the front of the oscillating head there is a shaft with a spur gear meshing with a pinion on the work spindle. This gear has on its face a trip dog for disengaging the rotary feed of the work after it has made a complete revolution past the milling cutter.

A Chaser for Cutting Lead Screws

Although thread cutting in an engine lathe is a very old operation, the chasing of a lead or other accurate screw, which shall be fairly accurate and also smooth, is still a problem in many shops. After much experimenting, the superintendent of a lathe-building shop where the screws to be cut vary from ⅞ to 1½ inches in diameter has come to use the following method as being the best for his particular work.

A chaser is used in place of a single-point tool, and it was found that much depended on the way in which this chaser was made. After considerable experimenting the result seems to show that by making the depth or thickness of the threaded portion of the chaser about one-third the diameter of the screw to be cut, it would do more and better work than if made any other thickness.



Chasing Lead-screw Threads

The chaser was cut with a hob 1/32 inch larger than the diameter of the screw to be chased. Then the top of the chaser must be set level, but 1/32 inch above the center of the screw to be cut. These proportions are shown in the accompanying illustration. They seem to give plenty of clearance and yet to form a support or guide for the tool in the thread, which holds the chasers steady and produces a smooth cut.

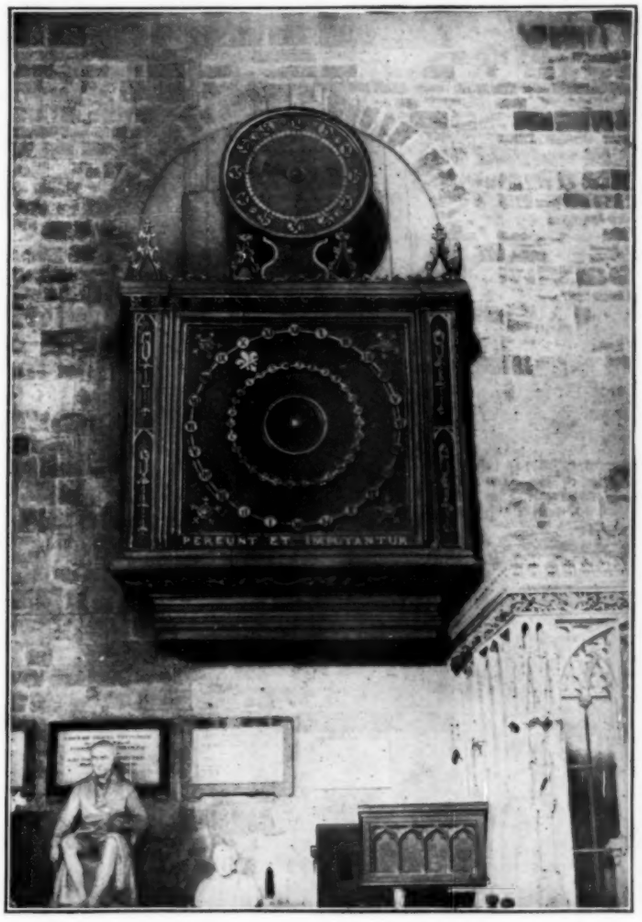
With this chaser the first cut was 0.015, the second 0.012, and decreasing down to the last cuts, which were only 0.002 inch in depth. This gave a very smooth thread, and where variations in stock might deflect a single-point tool, this was prevented in the chaser, owing to its wide bearing on a number of threads.

Two Famous Old Devonshire Clocks

By John James Hall

Clocks which centuries ago, and under the observation of watchers day and night, regulated the services of the church, and are still in action.

On page 294 of Volume 33, Part 2, there appeared halftones and a brief description of "Two Remarkable Old English Clocks," one of which, viz., the Glastonbury Abbey, afterward, from *circa* 1545, the Wells Cathedral clock, belongs to a quartette, to wit, the four most ancient astro-horological specimens remaining in the old country and peculiarly peculiar to the West of England, viz., that at Exeter Cathedral and the daughter Church of St. Mary of Ottery. The remaining example is to be found at the old Collegiate church of Wimborne, usually known as Wimborne Minster, in Dorsetshire. It is, briefly, of the oldest and youngest (there is only a difference in their births, seemingly, of some twenty-three years) that I propose to deal in this chapter.



Exeter Cathedral Clock Dating from 1317

Fig. 1. The Dial or Orrary and the Sylke Chantry Which Now Contains the Ancient Movements

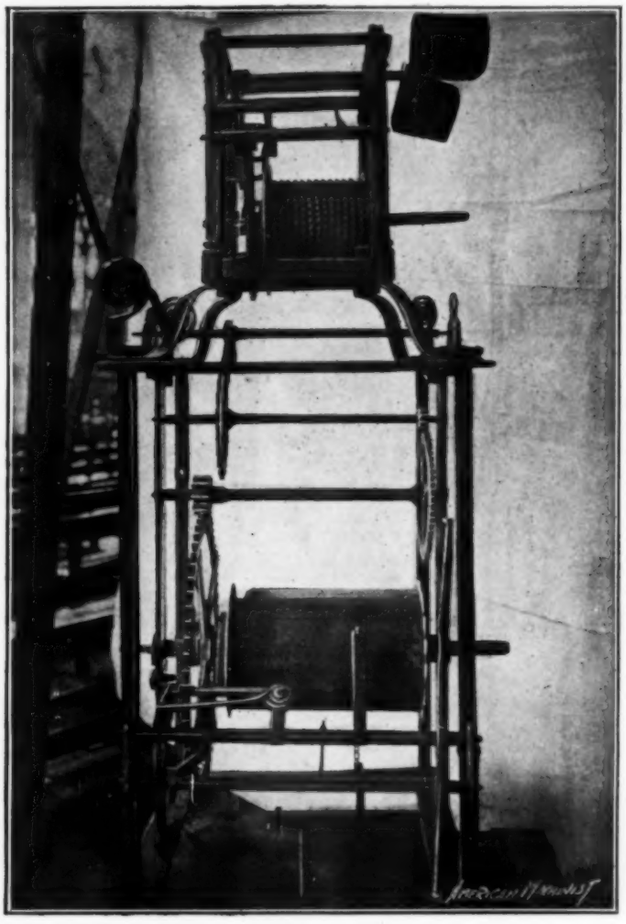


Fig. 2. Going and Quarter Trains

The Age of the Exeter Clock

That there was a clock in the cathedral at Exeter as early as 1317 (10 Edward II) is clear from the Patent Rolls of that and the following year. In 1328-9 a clock, doubtless the same, is mentioned by that great authority Professor Freeman as being in the nave, and this may safely be ascribed to Bishop Stapledon (1308-26) and not to Courtenay (1478-1486-7) as has been often asserted. In 1376-7 important new work was carried out when the clock was in all probability added to (possibly the *hour*-striking portion) the older portion being then removed into the North Transept where a chamber (not contemplated in the original building), according to the old Latin Records (Fabric Rolls), had been hewn to receive it. In 1423-4 there is quaint mention (in Latin) of a "new clock *still remaining*." But, considering the rude workmanship, general design, and ancient character of the older portion (See Fig. 2) one is irresistibly led to the conclusion that we have in the "going" and "quarters" portion, or "movements" (the one saddled above the other) the clock first referred to, and, if this be so, Exeter Cathedral may proudly and justly claim possession of the earliest astro-horological example in England; certainly, and without doubt, one of the very oldest clocks in existence.

The Dial

The dial, shown in Fig. 1, is arranged on the Ptolemaic system of astronomy which regarded the earth, represented by the central hemisphere, as the center of the solar system, the sun, represented by a *fleur de lys*, revolving around it. The inner and outer figured circles are divided—the former from 1 to 30 (29½) days (in Arabic figures), representing the moon's age, and the latter, or outermost

circle, into twenty-four hours, or two XII's, of which the uppermost represents midday and the lower midnight. The moon (half white, or silver, and half black), by its axial and orbital movement on the inner field, shows its varying *phases* (new, full, first and last quarters, etc.,) from day to day, while the aforesaid *fleur de lys* (the sun) points—outwardly, on the Roman numerals, to the hour of day or night; and, by its central stem, inwardly to the moon's age on the inner circle of figures. Prior to the year 1760 the main dial was only surmounted by cresting, but at this date the clock was entirely overhauled and the minute dial above added. The quarters 1, 2, 3, only were struck by the old, but the fourth has been added in the new "movement."

The motto upon the dial is—

"PEREUNT ET IMPUTANTUR"

[They (the hours) pass and are placed to our account].

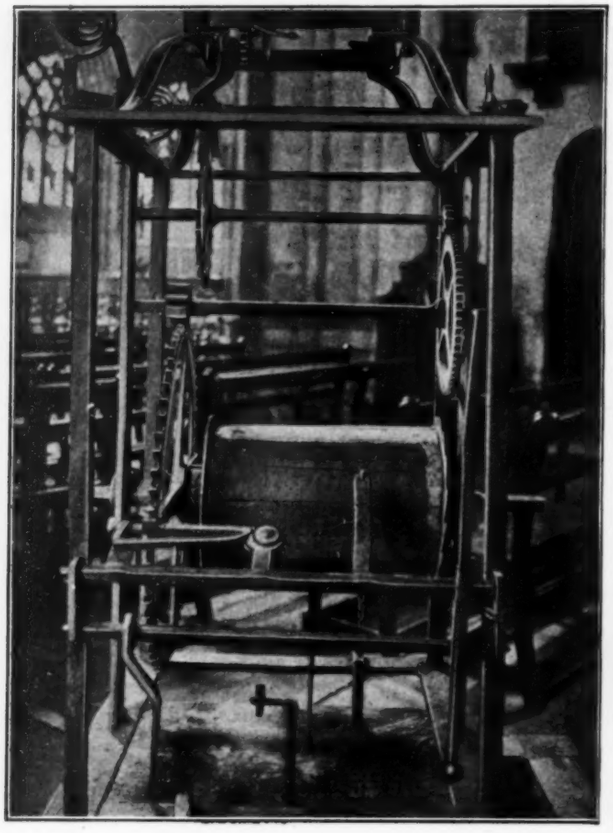
Entirely new "movements" were put to this dial, and to the striking portions, both below and in the transeptal tower above, in or about the year 1885, when the older were scrapped and have since been lying about in different portions of the cathedral. The whole, however, has now been assembled and placed on a stand of old cathedral oak in the Sylke Chantry (1909-10) and the "going" portion once more set in motion.

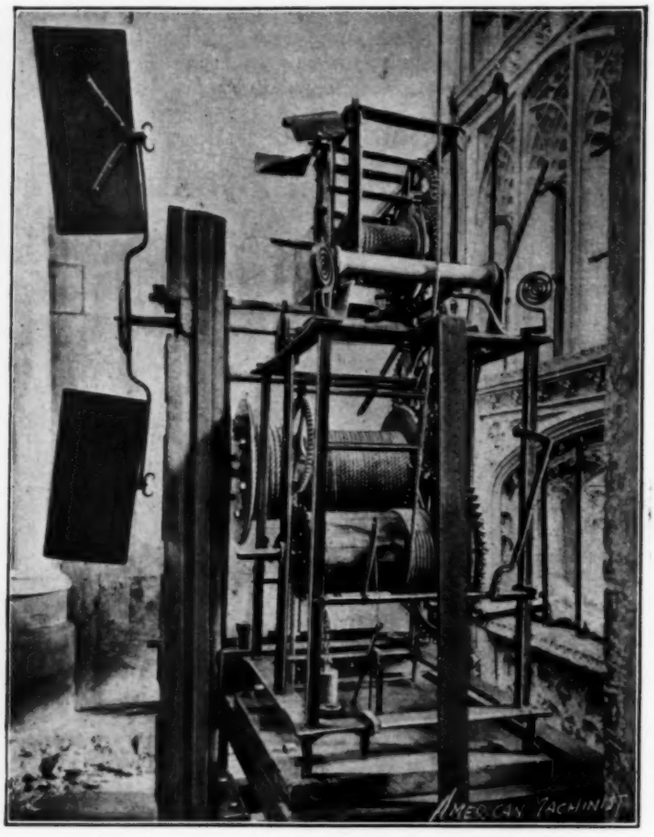
The Maintaining Device

One remarkable characteristic of the Exeter clock, but little known and in all probability nowhere else to be found, is the quaint arrangement for *maintaining power during winding*, a fact which places the device (of any form) centuries, it may be, before the date usually ascribed to its introduction. It is fairly well represented in Fig. 3, a photograph of the oldest portions of the clock taken prior to its being placed in its present position. On the right-side end of the barrel, usually occupied by what is called the barrel "cap," is a ratchet of 16 teeth, over which, when not in use, steps a "deers-foot" jointed click seen, on the lever, in an elevated position, near the second wheel—having been placed in that position by the depression of the knob-ended lever seen at the foot of the figure*, an act which has caused the triangular spring click, on the left, to snap, as it were, past the teeth of the main wheel in rising, but to work its way down again through the revolution of the wheel, the motive power being a small weight attached to the chain on lever seen just to the right of the center of the barrel—the weight shows in Fig. 4. During the ordinary going of the clock the "deers-foot" click, before mentioned, rises and falls ("steps") over the ratchet cap, but if an attempt to wind should be made without putting the "power" in action the dead face of the ratchet tooth which last passed is caught by the click and this prevents the barrel from turning. It is, in all probability, the oldest and earliest form of maintaining power in existence.

Another characteristic of this historic clock is the peculiar arrangement for discharging and locking the hour striking movement, formerly placed high up in the tower but now incorporated on the oak stand or "horse" before mentioned. In place of the square-cut slots now found on the periphery of locking plates, or wheels, a series of V's are to be seen on the inside edge of the rim. The whole arrangement is unique and is seemingly to be found only at Exeter and (probably copied therefrom, but at some time modernized), in part only, at Ottery St. Mary.

Fig. 4 shows the entire clock, of various dates, as now assembled and erected in Precentor Sylke's Chantry—to the right of the dial as seen in Fig. 1.





Exeter Cathedral Clock

Fig. 3. Showing the Ancient Maintaining Power Work Fig. 4. As Now Erected in the Sylke Chantry

*The reader will observe that, when riding on the ratchet, the click makes it impossible to wind the clock. Before winding, therefore, the click must be raised to the position shown, thus putting the maintaining device into action.—Ed.

The Ottery Clock

In Fig. 5 we have a representation of Bishop Grandisson's clock, *circa* 1340,

in the beautiful and historic church of St. Mary of Ottery, 12 miles distant, in an easterly direction from Exeter. It is unique among the churches of the world in occupying a special clock gallery, the clock floor being approached by a quaint fourteenth-century staircase within the lower paneling. There the "quarters"

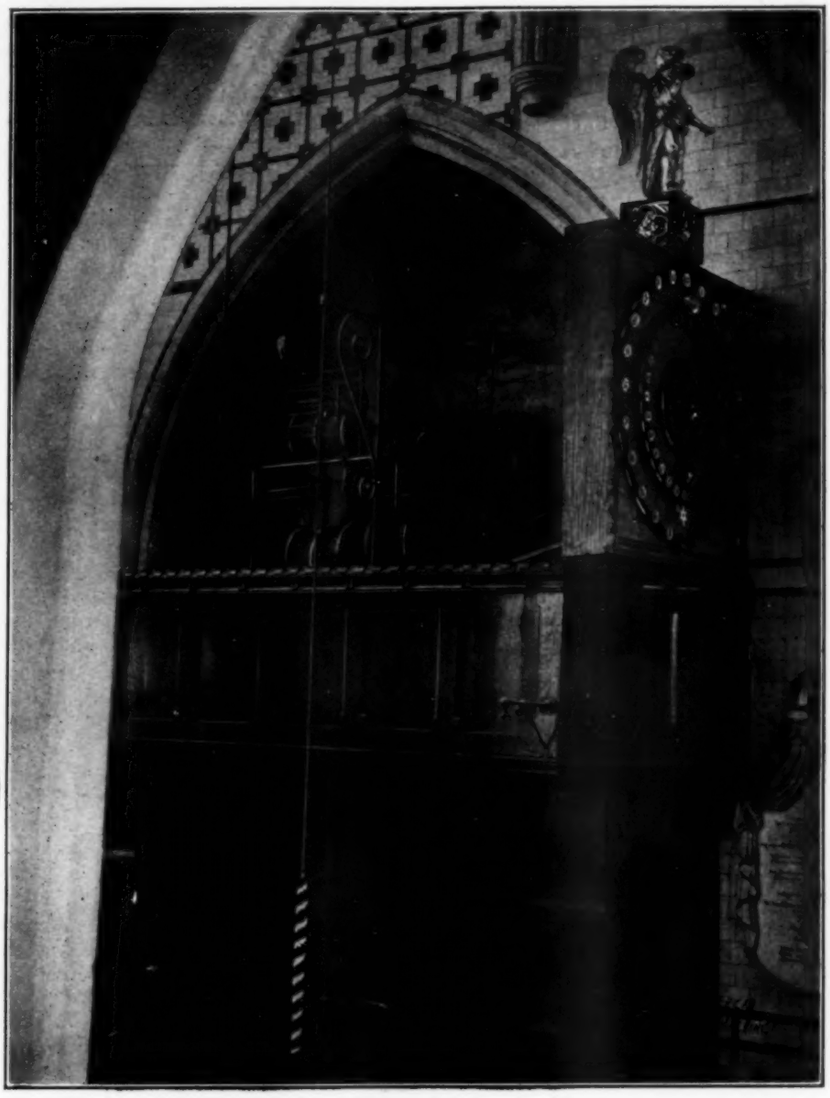


FIG. 5. BISHOP GRANDISSON'S CLOCK, OTTERY ST. MARY. DATING FROM 1340

portion, or "movement" is saddled—not as at Exeter above the "going" but above the hour-striking movement. The "going" barrel is still wound (the only one of the "quartette") in the most primitive fashion, viz., by spokes projecting from the barrel, the intersection of the iron cross thus formed being one of the barrel bearings to be seen in the figure. The quarter and hour striking portions (now silent, as at Exeter) were wound by means of reversed ropes and winches in the basement of the gallery.

Both at Exeter and Ottery are evidences of the old *foliot* (weighed arms) balance, of which an example is to be seen in the illustration of the Dover Castle Clock (which also has winding spokes) indirectly referred to at the outset. The Exeter and Ottery clocks must have started 265 and 242 years, respectively, before Galileo, then a youth of 18, discovered the synchronous motion of a pendulum while watching the swinging chandelier in the Cathedral of Pisa, in Italy, and 304 and 281 years, respectively, before the introduction of the pendulum into church clocks in England. The clock, as the writer has before said, originally possessed a quaint form of hour locking which is only now to be seen, in its entirety, at Exeter.

It will be seen that, like Exeter, the escapement is connected with the pendulum by means of a pallet lever and connecting rod. Like Exeter, too, later on, the old clock was "scrapped" in or about the year 1874 and the works lay *en debris* until 1906 when (also like Exeter in 1909) as a "labor of love" its restoration was taken in hand by the writer.

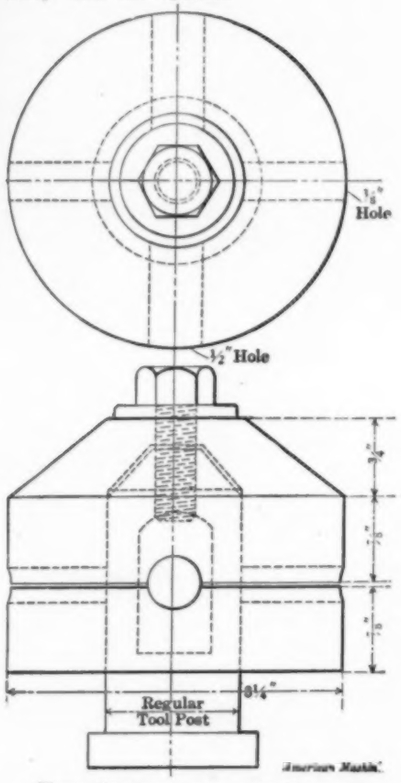
There is much in common between the two dials, Ottery differing from Exeter only in the fact that a golden hemisphere (formerly a star) now points the hours and, diametrically opposite thereto, a star the moon's age on the inner circle of figures.

The photographs are by the following artists: 1. Messrs. Chandler & Co., Arcade Studios, Exeter; 2 and 3. Fred A. Crossley, Knutsford, Cheshire; 4. Chas. S. Wheeler, Exeter; and 5. H. D. Badcock, Ottery St. Mary.

Tool Holder for the Lathe

A handy attachment for the engine lathe is shown in the sketch, as used in the shop of the Carroll-Jamieson Machine Tool Company, Batavia, Ohio. It consists of a pair of collars or disks about 3¼ inches diameter, placed over the regular tool post of the lathe, and bored out centrally for two sizes of tools, in the case illustrated ½ and ⅜ inch. The two disks can be separated by thin material when being bored out so as to allow a slight amount of clearance to enable the tools to be held tight.

The disks are clamped upon the tool by a cap screw which bears on a washer and which enters the tool post in place of the regular screw. The tightening of this screw secures the holder to the tool block of the lathe. The shank of the drill or other tool being held, can pass through the tool-post opening and thus be secured in both sides of the holder. The device is drilled and reamed in place on the lathe, after it has been located centrally with the spindle.



TOOL HOLDER FOR THE LATHE

Safety in Oxyacetylene Installations*

By Edwin H. White

Fundamental principles of acetylene, which, when understood, make the handling of gas a simple and safe proposition.

A decided difference between liquid acetylene and dissolved acetylene, which is often a confusing element.

*Copyright, by Edwin H. White, 1911.

It is my intention to cover this subject in a fairly broad way, that the reader may have information more complete than is usually secured from a concern who has apparatus to sell, and whose treatment of the subject may be influenced by self-interest.

If a thing is good it can be proved in successive steps just like a problem in mathematics. Thus, in the consideration of oxy-acetylene's safety, we must supplant vague impressions and hearsay with real knowledge.

In this subject the successive steps lie in noting the nature of acetylene and of the material from which it is generated, the proper method of generating, the factors which make for safety in an installation of generating equipment, and the points of safety in the design of torches.

Of all gases acetylene is probably the least understood. So it will be well to have it known at the start that the discovery of acetylene antedates the discovery of calcium carbide from which the gas is made. The properties of the gas have been known for many years. And right here it can be stated, in all candor, that every difficulty attending the use of acetylene may be traced directly to the ease with which the gas may be made by bringing carbide in contact with water—regardless of how this is accomplished. The above mentioned ease of making acetylene tempted, in the early days of the industry, the "invention" of numerous devices and methods of gas storage and transportation which were wrong in every fundamental point. Even now it is not unusual to find instances in which engineers, possessed of more egotism than judgment, are devising apparatus that "beats them all"—and blows up. But this is no reflection upon the gas, which, unfortunate as it may be, obviously cannot supply the brains that should be employed in its handling.

Let us now proceed to take the mystery out of the matter.

Acetylene Not a New Gas

The existence of acetylene as a separate and distinct hydro-carbon gas has been known since 1836. It was not, however, until 1892 that calcium carbide was discovered by the Canadian chemist, Willson, and the production of acetylene as a gas by itself, made commercially practicable. Soon after Willson had given acetylene to the world, through his discovery of carbide, Vivian B. Lewes, F. I. C. Professor of Chemistry, Royal Naval College, Greenwich (England), made, in collaboration with other noted engineers and scientists, an exhaustive study of the gas. Quoting from Lewes' work:

"In a coal-gas flame burning in air acetylene is always formed in the interior of the flame itself, as when the gas leaves the left at which it is being burned, those portions which come in contact with the air, are consumed and form the wall of the flame which surrounds the issuing gas. This unburned (issuing) gas in its passage through the lower heated area of the flame undergoes a number of chemical changes brought about by the action of radiant heat emitted by the flame walls, the principal action being the conversion of the heavier hydro-carbons into acetylene, methane and hydrogen. The acetylene so formed is decomposed in the hottest part of the flame—which is just below the outer zone of non-luminous combustion—and yields the carbon particles which render the flame luminous."

It will be seen from the above that the vital principle in all self-luminous gases is carbon. If it were not for carbon, city gas, with which all are familiar, would not be luminous, and there could be no such thing as kerosene, gasolene, natural gas, etc., all of which partake of the nature of acetylene, which differs only from them in that in a pure state it consists simply and solely of carbon and hydrogen and is richer in the first mentioned than any other gas known today.

The Nature of Acetylene

Avoiding fractions, pure acetylene is practically 93 per cent. carbon and 7 per cent. hydrogen. Its composition is represented by the symbol C_2H_2, and as the symbol shows, its molecule is two atoms of carbon and two of hydrogen.

Acetylene can be liquefied at a pressure of about 26 atmospheres at 32 degrees Fahrenheit. This is approximately 400 pounds pressure per square inch at freezing temperature and about 700 pounds at 70 degrees Fahrenheit. The critical temperature of liquid acetylene is 98 degrees Fahrenheit, at which point no pressure will suffice to hold acetylene in the liquid state.

In the early days of the industry there were many accidents, due to the employment of liquid acetylene, an error chargeable entirely to ignorance.

Above two atmospheres pressure (and under certain conditions at above 22 pounds gage) acetylene may, if sparked or shocked, as for instance with a fulminate cap, be made to dissociate, that is, the molecules of carbon and hydrogen fly apart. As this is accompanied by some evolution of heat there is in consequence an expansion of the gas. A very fine grade of carbon for pharmaceutical purposes is now being made in Europe by dissociating acetylene. Containers sufficiently strong to withstand the expansion are provided.

Considering the above data, we note that acetylene at above 22 pounds gage pressure is an unstable compound. Obviously, an acetylene generator operating at a pressure higher than the above would be unsafe, for the actuating of any part having a bearing on the interior of the machine might cause a spark and explosion of the apparatus; such a hazard, however, cannot exist in a modern, well designed generator, first, because generators that are approved by the National Board of Insurance Underwriters are provided with a relief valve of positive construction, which permits the release of the gas the instant the pressure goes above fifteen pounds per square inch gage. Further; the hazard is obviated because of the fact that if acetylene is taken directly from the generator at greater than ten pounds per square inch (gage) the welding torch will not stay lighted, for the velocity of the gas in such a case is greater than the speed of ignition.

The hazard in liquid acetylene is apparent, in that at the very high pressures of liquefaction an ordinary blow on the tank is sufficient to cause dissociation of the gas, and, further, the heating of the container above 98 degrees Fahrenheit causes the liquid to return to gaseous form, thereby causing an increase of pressure which no tank of construction practicable, from a commercial standpoint, would withstand.

The reader should not confuse liquid acetylene with dissolved acetylene. They are totally different propositions. Dissolved acetylene is acetylene which has been absorbed by acetone. The employment of acetylene by absorbtion into acetone is considered absolutely safe. The tanks, or containers are filled with a porous material. The material usually employed is asbestos. By this arrangement there is never any free space above the liquid. The tanks are weighed every time they are refilled and any loss of acetone is made up. There is some loss, of course, for a small amount of acetone will be

carried out with the acetylene. A tank of dissolved acetylene can be sparked or shocked to the heart's content, the saturation of the acetylene into the acetone and through the porous material imposes a physical condition against the propagation of an explosive wave.

Due to the safety of dissolved acetylene, it was at one time thought that tanks of same would discourage, if not annihilate the manufacture and sale of acetylene generators.

Acetylene Generators Must Be Used

There is a consideration here not related to safety, but which is worth mentioning, viz.: more acetylene gas can be transported in the form of calcium carbide at less cost than in any other way. A can of carbide measuring 13 inches by 23 inches weighs 100 pounds, and as the carbide will yield not less than four cubic feet of gas to the pound, we, therefore, in this small container are shipping the equivalent of 400 cubic feet of acetylene. Twenty cans of carbide, or one ton, thus makes available 8000 cubic feet of gas provided an acetylene generator is used. Since carbide costs, in most sections, $70 per ton, freight included, the cost of acetylene evolved from it in an acetylene generator is one cent per cubic foot. This is about 50 per cent. less than dissolved acetylene can be purchased in cylinders not so large as to be cumbersome. The cylinder usually employed weighs 168 pounds and contains 225 cubic feet of gas. Inasmuch as an average installation calls for an output of from 400 to 800 cubic feet of acetylene daily, it will be seen that the multiplicity of cylinders required for commercial work would entail an almost prohibitive initial investment and, what is even more important, the cost of the gas itself would prove a severe tax on the cost of welding. There are instances, of course, in which dissolved acetylene should be employed in preference to all other methods of acetylene supply. But as this article is written on the subject of safety, comment in this direction is out of place.

Three Spindle Vertical Miller

The illustration, Fig. 1, shows a three-spindle vertical miller of rather novel construction and of the type sometimes called a station machine. It has a great capacity for the production of parts to be surface milled.

It is seen to consist of a cylindrical base having a circular, horizontal table with one T-slot and a vertical cylindrical table with two T-slots. Above the tables and spaced 120 degrees are the three spindles with their driving mechanism, and above all the driving electric motor.

The point of application of power is almost ideal for a vertical motor, as its shaft is connected directly to the vertical driving shaft of the machine by means of a sleeve. The three cutter heads are driven from a single worm on a vertical driving shaft through three worm gears running in oil. See Fig. 2 for the arrangement. The drive is then through a set of bevel gears, the driven one being splined onto the cutter-head spindle.

Each cutter head has a long bearing surface and is adjustable for hight by means of a handwheel, see Fig. 1. Power for the table feed is transmitted to the platens by the vertical shaft running direct from the motor. The connection is through a worm and gear to a cone of three feed-change gears, thence through

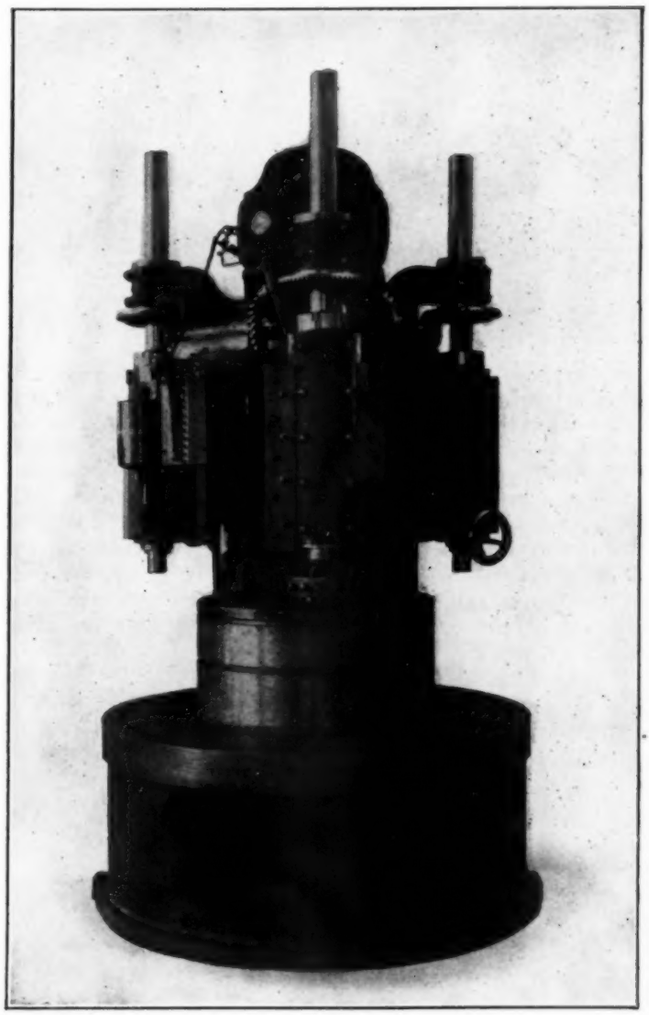


Fig. 1 Three-spindle Vertical Miller

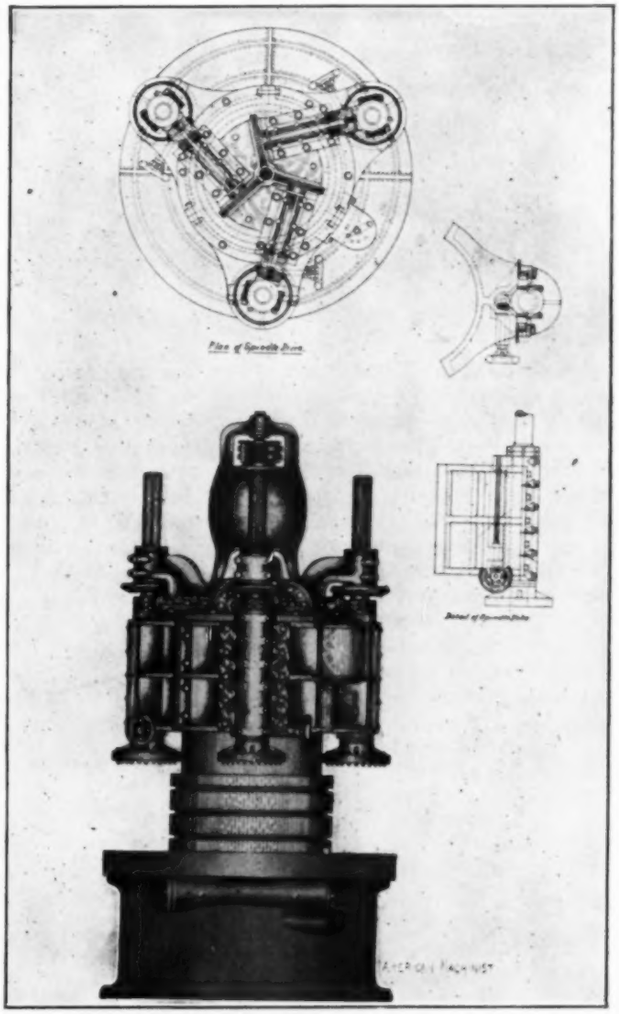


Fig. 2

2 to 1 spur gears to a worm, which in turn meshes with a 48-inch gear bolted to the bottom of the horizontal platen. The range of feeds is from 4 to 11 inches per minute, measured at the circumference of the 60-inch horizontal platen.

Operation of the Miller

Fixtures are fastened to the horizontal or vertical platen, or both, and as many as can be located around the machine are used. As the cutter heads are 120 degrees apart, one or more fixtures will always be in the space between two adjacent heads. From this position work can be removed and other work entered before the fixture comes under the next working head. By this method there is practically no lost time. The heads can work continually, and the operator does not have to wait for the work to come out from under the heads, as there are always one or more fixtures ready to receive new work.

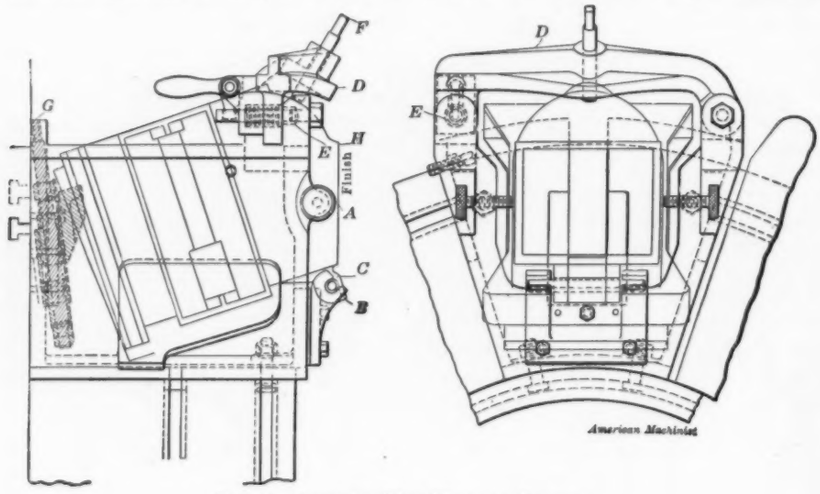


Fig. 3. Journal Box Milling Fixture

Because of these features, care must be used to design quick-operating fixtures, so that the operator can keep all three heads at work.

Fig. 3 shows such a fixture designed for car-journal boxes, and built for T. H. Symington Company, Rochester, N. Y. These boxes are surface milled where the cover seats, and in some cases the joints are required to be water tight. The top of the journal box shown at *A* is finished to dimension from the top of the hole in the lug marked *B*, thus allowing a pin to be put through the lug. The box is then placed in position as shown, with the pin resting in the slot *C*. The yoke *D* is then swung into position and locked to the plunger *E*. A socket wrench is used on the screws *F* and *G*. Screw *F* tightens the box in position after the surface *H* has been raised by the screw *G*, so that it will clean up.

In this fixture a finished box has been taken out and replaced in 30 seconds.

The average production is very nearly one box per minute, or an increase over the old method of machining on a rotary side planer of about 450 pieces per day.

The limit of work which can be handled on this machine is that which can be covered by a 16-inch cutter head. The machine weighs 16,500 pounds, and is proportioned to withstand the stresses occasioned by the use of high-speed steels.

This machine was designed by and built under the supervision of Hanford & Barkley, Rochester, N. Y.

Taking Care of Injuries in the Shop

By W. A. Grieves*

About three years ago we made a careful study of the number of men who were off work owing to slight injuries, which in themselves were not serious, but through the lack of proper antiseptic treatment, had become infected. Our records showed that on an average as high as a half dozen men were away from work daily for this reason. As it had always been our policy to pay wages for a portion of the time lost by employees through injuries, this investigation revealed a condition that represented a two-fold loss.

We reasoned that under proper antiseptic treatment these infections could be reduced to a minimum, and not only would we save the amount of the employee's wages, but also the greater loss occasioned by a decreased production.

It was not unusual to find some of our most skilled and highest paid mechanics off work for several days because of infection caused by a slight cut or bruise, and when you count what that may mean in decreased production, not only of the injured man himself, but also the possible hold up of an order all along the line, it is not easy to determine the loss.

From the standpoint of cold business this condition demanded a remedy. We at once set to work and thoroughly equipped an emergency hospital and placed a regularly graduated physician and trained nurse in charge. The doctor's entire time is given to the hospital work and he is assisted in the mornings with the re-dressing by the nurse. The nurse's time in the afternoon is given up entirely to visiting sick or injured employees or their families.

Out of some four thousand cuts, bruises, sprains, etc., together with re-dressings to the number of over four thousand last year in our plant, the infections resulting did not average more than four per month.

You may ask of what direct benefit to us is it to have the doctor treat such ailments as colds, indigestion, headache, cramps, sore throat, boils and all the other ailments noted in the list. We answer for the very same reason that it pays us to prevent infection resulting from injury. For the reason that if a man is valuable to have in our employ, he is more valuable if he is in a good physical condition. If an employee has a headache or cramps, it is more profitable to have him treated at our own plant, relieved of his suffering, and sent back to work within an hour, than it is to have him lose a whole day. Then, too, the work our doctor does in the way of preventing illness among our employees by prescribing when the first symptoms are evident, cannot be over emphasized. Dozens of cases of this kind have been brought to our attention. The men are more and more taking the doctor into their confidence, and he is teaching them, in many ways, how to live better physically.

During the past year our nurse made 989 personal calls in the homes of our employees, all of which were made on account of illness or accident to employees or their families. It would be impossible to enumerate at this time the far-reaching results of a work of this kind. From the mission of helping to sooth the pains of a sick baby or consoling the sorrow of a mother discouraged, to that of the work of a truant officer in finding whether the employee reported ill is really sick or away on a fishing excursion, the diversity of this nurse's duties may be realized.

We have so many calls from the homes of our employees on account of illness of the wife and children. It was quite common for some of our most valuable men to be away from work on this account. Now, instead of the men going home, the nurse is sent instead

Another place where the nurse's services have proved to be of financial value is when an employee is injured and is away from work, she is a medium of good-will and interest. Her assurance of fair treatment makes the ambulance-chasing lawyer's business very slim.

*Jeffrey Manufacturing Company, Columbus, Ohio.

Unusual Shop Tools and Methods

By Ethan Viall *

A special lathe for turning a printing-press cylinder having two segments of different radii.

Turning balls and sockets.

A novel milling job and spiral miller.

Roller bearing driller table.

*Associate editor.

The Brown Cotton Gin Company, New London, Conn., manufactures a line of special machinery and printing presses, the parts of which call for tools and fixtures not generally known.

Press cylinders are made of one solid casting, but the periphery is divided into two sections of different radii, as shown at *A* and *B*, Fig. 1, the surface of *A* being about ¼ inch higher than that of *B*, and the way these two surfaces are turned in the lathe shown is interesting. The carriage *C* carries two cutting tools and is fed along by pitman *D*, which operates a dog and pinion on the lead screw as shown. In order that the two cutting tools on the carriage may each machine only the surface for which it is intended, the shifting mechanism shown in detail in Figs. 2 and 3 is used.

Fig. 2 shows the lowest of the two sections being turned off by tool *A*, tool *B* doing no cutting, as it is set for the higher surface. As the cylinder continues to turn, tool *A* starts to cross the gap, when lever *C* strikes the unmachined surface of the high part and lifts tool block *D*, so that the point of tool *A* clears the high section. Tool *B* now begins to cut and continues to do so until the gap on the opposite side is reached when lever *D* drops in and allows tool *A* again to cut, the stationary tool *B* passing over the lower surface as before. By using this simple mechanism, both surfaces are machined by the shifting of only one of the tools, and after the cylinders have been roughed off, a finishing cut is taken in the same manner.

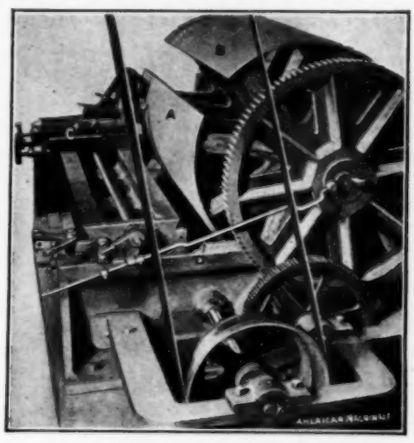


FIG. 1. FEED CYLINDER TURNING LATHE

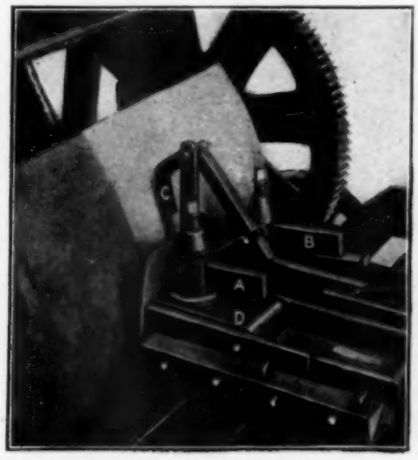


FIG. 2. TURNING THE LOW SECTION

FIG. 3. TURNING THE HIGH SECTION

VARIOUS RACK MOVEMENTS

The use of racks in different forms is extensively employed for giving the motion necessary to machine some of the parts, and in Fig. 4 is shown the fixture used for machining balls for a ball-and-socket joint. A base plate *A* is doweled and bolted to the carriage saddle and upon this a tool post and block *B* is mounted in such a way as to be free to turn. A pinion is fastened to the bottom of *B* and meshes with rack *C*, which is bolted to the cross slide *D*, so that as the cross slide is moved the part *B* will rotate.

Adjustment for different sized balls or for feeding in the cutting tool is made by turning the screw *E* which operates the slide. This fixture is easily detached from the lathe at any time, leaving it in shape for regular work.

The sockets for these balls are machined inside with the tool shown in Fig. 5, in which the rack principle is again used.

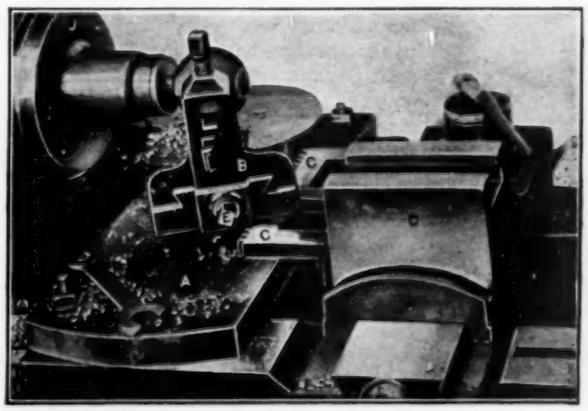


FIG. 4. TURNING A BALL

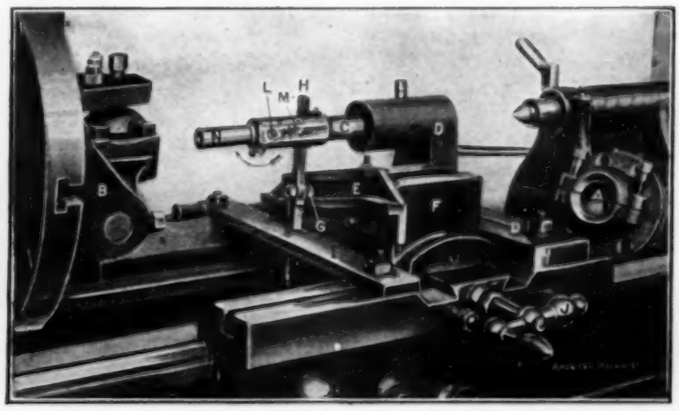


FIG. 5. TURNING A SOCKET

The sockets are made in halves and these are first fitted, bolted together and the flange finished as at *A*, they are then placed in the faceplate jig *B* and roughed and finished inside with the tool illustrated.

The fixture consists of a revolving table *B* with a gear segment *C* cut in it and the gear blank is fastened to this table so that it is impossible for it to slip. The gear segment meshes with the rack *D* which is bolted to the bracket *E*, which in turn is bolted to the knee of the miller, so that movement of the miller table rotates the table *B* and the gear blank fastened to it. Clamps *F*, *G* and *H* are merely friction clamps used to prevent the work from chattering under the cut, small pieces of wood being placed between the ends of the clamps and the gear blank to allow the necessary slippage. Originally it was calculated that the friction ring *I* would be sufficient to prevent chatter, but actual trial proved that it wasn't sufficient so the clamps were added.

In use, the gear blank is set with the periphery even with the center of the spherical cutter *J* and far enough back to clear nicely, then the miller is started and the table fed in, the gear blank rolling around slowly past the cutter, leaving a finished socket as shown.

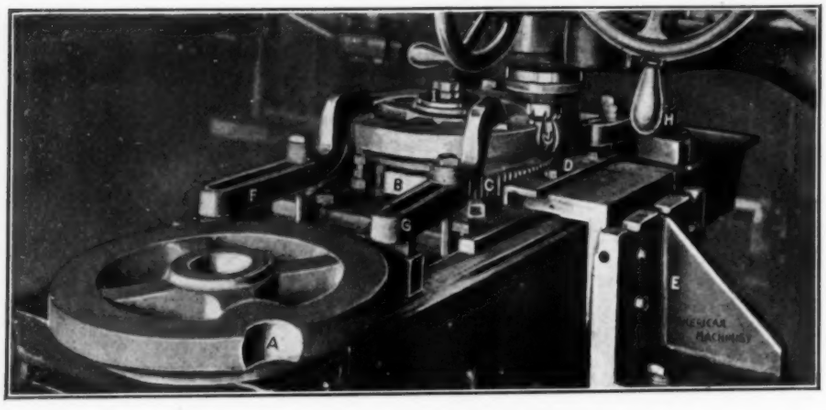


FIG. 6. MILLING A BALL SOCKET IN A GEAR BLANK

A SPIRAL MILLER

Still another use of a rack is shown in Fig. 7. This machine is used for milling long spirals, such as shown in the shaft *A*. The rack *B* is bolted to the bed of the miller and the rotary motion is given to the shaft to be cut, by means of the gear *C* and a pair of bevel gears at *D*, and as the table feeds along the desired turn is given, the principle of which will be readily grasped.

The table feed is operated by the pulley *E* through the worm and worm gear *F*, which run a chain of bevel and spur gears in the bed of the miller which engage a rack on the underside of the table. Feed is thrown in by tightening the knob *H* and a knockout lever is shown at *I* which is operated by a stop on the table.

It will be noticed that the spiral cut in the shaft shown in the machine runs right and left from the middle; this is done by

The cutter bar *C* of this tool is set into the bracket *D*, which is bolted solidly to the carriage saddle. A cam slide *E* is bolted to the tool block *F* and in this cam slide, a roller *G* pinned to the rack *H*, travels. Rack *H* runs through the bar *C* and through a crosspiece *I* bolted to the saddle, so that if the tool block is fed in by turning the handle *J*, the rack is forced up and *vice versa*. Cutter *K* is set into a gear segment which revolves on pin *L*; another small gear meshing with gear *L* and rack *H* revolves on pin *M*, so that by running the tool block *F*, in, the cutter is made to travel in an arc in the direction indicated by the arrow. Pilot *N* fits into a bushing in the lathe spindle and steadies the bar and cutter when in use.

A NOVEL MILLING JOB

Ball sockets, that are really spherical teeth, are milled in gear blanks which are used in the table-reversing mechanism of printing presses, in the way illustrated in Fig. 6, one of the sockets being shown at *A*.

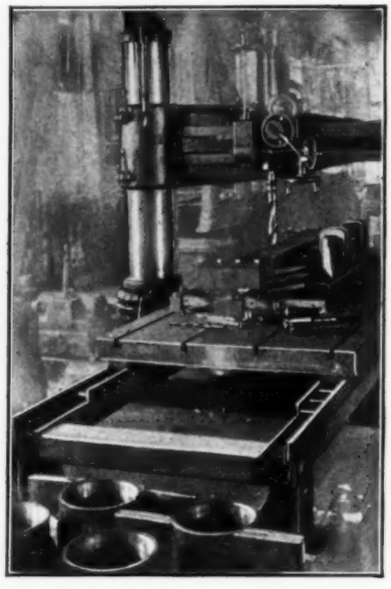


FIG. 8. A ROLLER-BEARING DRILL-PRESS TABLE

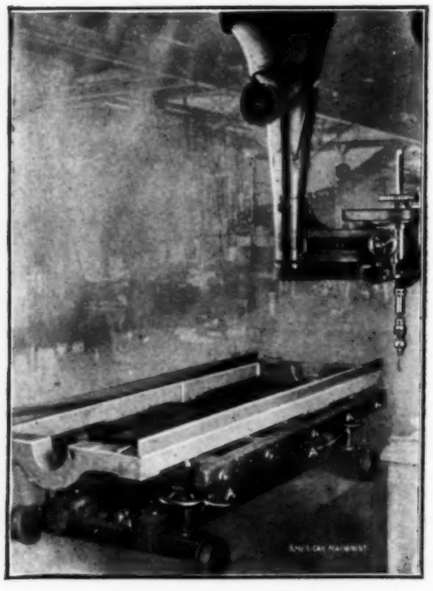


FIG. 9. A CEILING RADIAL AND WORK TRUCK

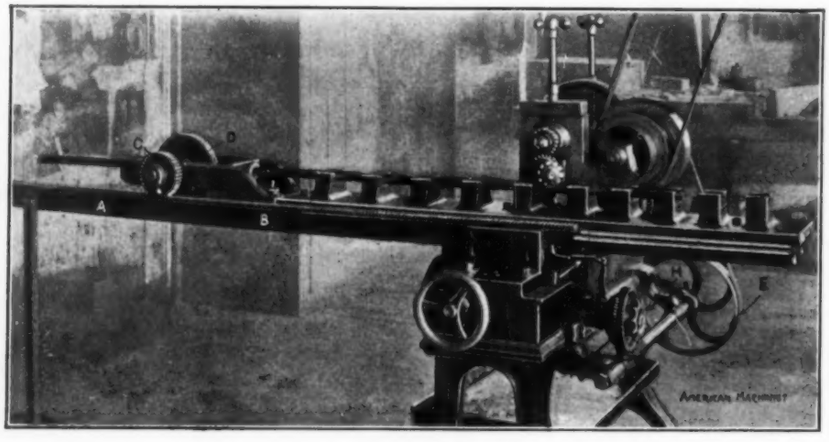


FIG. 7. A MACHINE FOR MILLING SPIRALS

cutting one-half and then reversing the work.

A Roller-bearing Driller Table

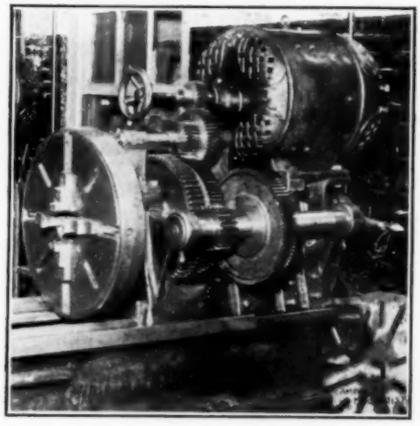
Fig. 8 shows a special radial driller table mounted on roller bearings, which makes it possible for a man to push the table along easily though it may be heavily loaded, which would be almost impossible with the ordinary V bearings.

The driller shown is equipped with a quick-change chuck, making it possible to use all the different tools in succession without stopping or even slowing down the spindle.

Fig. 9 shows a ceiling radial under which a truck runs on a track. This truck is very convenient for use in drilling large frames of various kinds and it may be easily leveled by means of the screws and handwheels *A A*, one of which is placed at each corner.

Applying Motors to Machines

The illustrations show several typical applications of motors direct to machines which were formerly belt driven. These are from the shops of the Chicago Railways Company and the motors are of the variable-speed type made by the Reliance Electric and Engineering Company, Cleveland, Ohio.



Applying a Variable-speed Motor to an Old Lathe

Chief Engineer John Z. Murphy, of the railways company, has recently converted all their machines to individual drives along the lines shown.

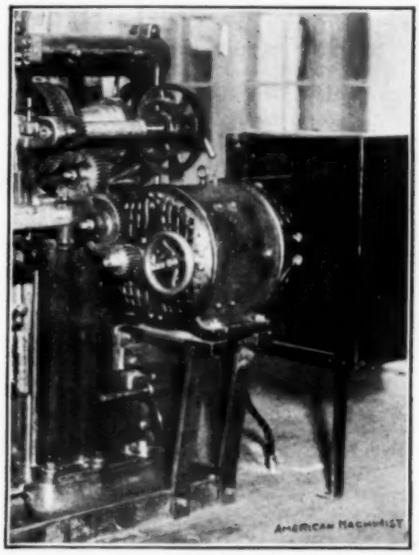
Estimater—Rate Fixer—Inspector

By P. E. Lowell

In reading the article on the above, at page 502, Volume 34, I find that I agree with a good many of the statements; at the same time it seems to me that the plea for coöperation between the estimater, ratefixer, inspector and foreman is in danger of being strangled by the spirit of antagonism breathed toward the introduction of these men; the ratefixer apparently being the most objectionable.

Mr. Forman refers to the time when the shop foreman estimated for work, and fixed his own piece prices and it is an open question if he does not still think this is the best way.

But would this be in accordance with the general trend of engineering practice? Years ago, when competition was much less keen, estimates when given at all, could be made so high as to cover the most remote contingencies, (I know of several instances, within the last 5 years where the foreman sent men back to book more time on jobs because they had not come up to his *estimate*) and there was consequently little difficulty experienced in coming out on the right side. But conditions today are changed and are in no way comparable to those obtaining say 20 years ago. The keenness of competition existing now was undreamt of then; a few manufacturers stood head and shoulders above all others and could command their own prices. Today they have to fight with a host of people, all making a similar article, all wanting to sell, and therefore, all quoting the lowest possible prices. One result of this is intensified competition in the workshop, a demand for better tools, cheaper methods, and less waste. This has meant practically a revolution in workshop practice and management. In those days interchangeability was not even thought of. Today, it is NEVER forgotten; it is a part of the revolution. To manufacture economically is to manufacture in quantities, and to manufacture quantities economically it is necessary to insist on interchangeability.

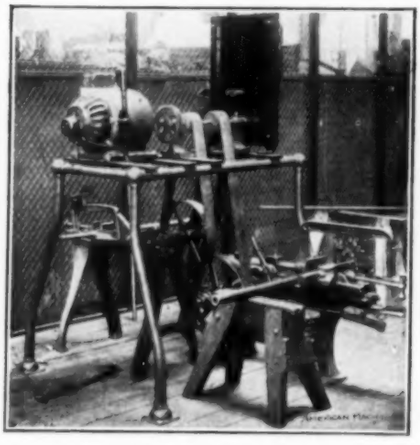


5-horsepower Motor on Kempsmith Miller

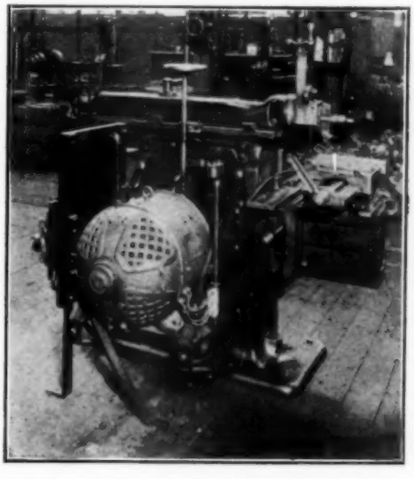
Interchangeability and economy are best obtained when operations are well split up, each man or girl having just one particular bit to do. These are the conditions which are largely responsible for the creation of the "inspector" and also for the production for the specialist and they being forced upon us largely by the commercial world, we are hardly in a position to avoid them.

To meet these changed conditions, and to make sure that every section of the works is up to date, the specialization which is now taking place in the shops among workmen, is spreading to the staff. In just the same way that a mechanic used to be fitter, turner, slotter and driller combined, so was the foreman, the estimater, ratefixer and inspector. Today, however, he is being relieved of those duties, not that he is less trustworthy, but partly because the duties of a foreman are becoming more complex every day, and he has quite sufficient to do if he insures that all his work is being handled on the right machines and by the right methods; because it is by method that a shop lives or dies and very much more so today than of old.

If the foreman is to be relieved of certain duties, is it not better that those



Driving a Pair of Hack Saws with a 1-horsepower Motor



3½-horsepower Motor on Shaper

duties should be of such a character that they can be undertaken by another man, with as little clashing as possible. Surely ratefixing is one of these, especially in large works where there may be several engineering departments, and consistency of prices, a thing much to be desired, becomes easily obtainable, inasmuch as all ratefixing is carried on under the same supervision; whereas if done by the foremen each is a law unto himself. Another reason in favor of ratefixing being undertaken by a separate authority, is that the rate department should keep the records of work done. This is essentially an office job, and as such is better undertaken by a separate department than by the foreman. Again, if undertaken by the foreman the record is purely departmental but undertaken by an office is general for the whole works—a most important consideration.

But what is more important the ratefixer becomes an expert, a specialist, and as such should be decidedly more reliable than the foreman who has other duties to consider.

Mr. Forman says, "To adjust piecework prices an exceptionally capable foreman mechanic is an absolute necessity." I would say after long experience with a considerable number of foremen that excepting in those cases where the foreman had been a ratefixer the majority would prove themselves less reliable than the ratefixer, not because they were less intelligent or poorer mechanics but simply because they would lack the ratefixer's training.

There is another point in favor of the introduction of these men, and that is because it is becoming more and more the practice to bring the work of each department and every man, under general review, and what the inspector does for the job, the ratefixer does for the method. Naturally if a job is being done on a machine or by a method which will make it cost 5 shillings and the ratefixer sees a way of doing it for 2 shillings he will suggest it to the foreman. And just here is the kernel of the trouble. The foreman, hitherto immune, resents criticism, (a suggestion is often looked upon as criticism) and the more room for criticism the more does he resent it. On the other hand the more competent the foreman, the less chance for suggestions, but generally speaking the more ready is he to accept and use them.

Through the ratefixing department a fresh avenue of practical knowledge is opened up, as expert as that of the foreman himself; leakages are arrested, and many improvements made. The men in this department are specialists. Regarding the charges that the ratefixer is a kind of half clerk, half mechanic of moderate ability; this is a matter entirely for the management to decide. The men chosen for ratefixers should be mechanics of the highest ability and while one finds misfits everywhere occasionally among foremen, as well as ratefixers and inspectors, the management responsible for such choices as those mentioned by Mr. Forman, deserve to reap what they sow.

The same remarks will apply to the estimator. Estimating entails work of such a character that it can be better done by others than the foreman. The question of records again applies. The shop foreman, if his work is to be properly done, could not spare the time necessary for the satisfactory estimation of the labor cost of a whole machine. What time would he have for surpervision?

Mr. Forman thinks that both estimator and ratefixer hope to make lucrative positions for themselves by making their prices low. He then goes on to say that if the price be not, in the man's estimation, high enough, he will not go for the work. Does Mr. Forman think that low estimates and high cost of production tend to make lucrative positions? Hardly so; and nobody realizes this more than those concerned.

In conclusion, there should be the heartiest coöperation between all the people mentioned, they are all working for one end; but without wishing to say anything of a disparaging character to foremen as a body (as a body they contain some of the finest men intellectually, and clever men, mechanically) yet as a ratefixer I must say I have found foremen backward in offering coöperation, and I know in some cases it is not merely the man that is objected to, but his office.

A Few of the Mechanical Features of a Chain Saw

The sawing machines made by the International Endless Chain Saw Company, New York City, have several mechanical features that are worth noticing.

Frames for holding the saw blades of the small motor or gasolene engine-driven machines are automatically balanced by a sliding weight, as shown in Figs. 1 and 2, which keeps the parts in perpetual equilibrium.

In the first halftone with the saw and frame in a nearly upright position the weight *A* is at about the middle of balance lever *B*, but in the second halftone with the frame and saw nearly horizontal, the weight has moved out toward the end of lever *B* preserving the balance,

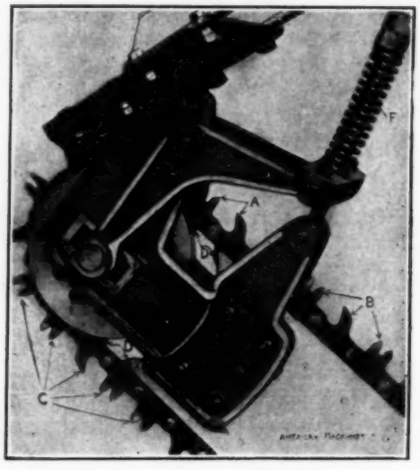


FIG. 3. DETAILS OF SAW AND TENSION DEVICE

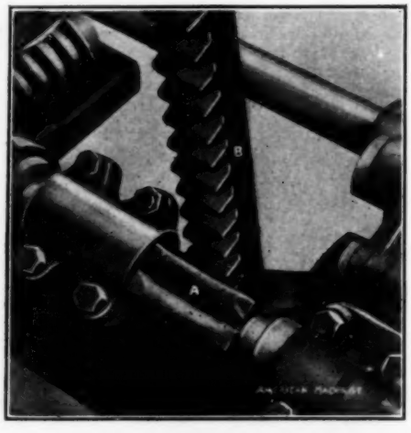


FIG. 4. AN UNUSUAL PINION

so it will be readily seen that no matter in what position the saw is shifted by means of the hand lever *C*, the balance is perfect.

The chain saw itself is made up of punched-steel sections riveted together as

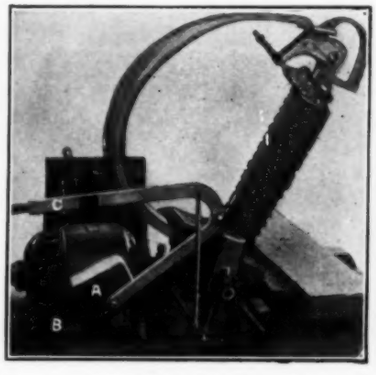


FIG. 1. AUTOMATIC BALANCING DEVICE WITH SAW RAISED

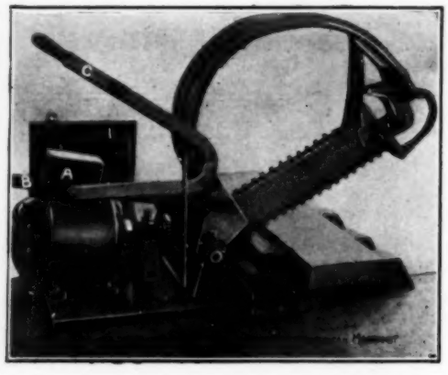


FIG. 2. SAW HALF WAY DOWN SHOWING PERFECT EQUILIBRIUM

shown at *A*, *B* and *C*, Fig. 3. These sections have teeth on one side and a guide *D* on the other, the cutting teeth being spaced or set enough to give clearance for the saw blade. The saw blade is made up of three pieces of flat steel, two wide and one narrow, riveted together so as to form a channel on each edge for the link guides to travel in as shown.

The chain is driven by a sprocket at the inner end of the blade and runs over another one at the outer end, which is mounted on the forked tension device *E*, the spring *F* of which keeps the chain taut at all times, yet allows the "give" necessary in a mechanism of this kind.

Fig. 4 shows an unusual form of pinion at *A*, which is four-toothed and made from square stock turned down for the shaft and then milled out as shown. This pinion in conjunction with rack *B* is used as part of an elevating or leveling device on the frame of some of the large sawing machines.

Machining a Large Generator Frame

Special Correspondence

How a 27-foot steel casting for a generator frame is handled on the floor-plate machine.

An interesting bearing construction using a journal box on the lower half of the bearing only.

Many of our readers will probably recall that we have shown on previous occasions work performed on the floor-plate machine, and in Fig. 1 is illustrated a job of this kind that is especially interesting on account of the large piece of work handled and the record time in which it was machined at the plant of the Crocker-Wheeler Company, Ampere, N. J.

The frame is a large steel casting 27 feet in outside diameter which when completed will become a part of a generator intended for service on the drainage canal of the sanitary district of Chicago. It is to be of 4000 kilowatt capacity and will be direct connected to a water wheel of 6000 horsepower.

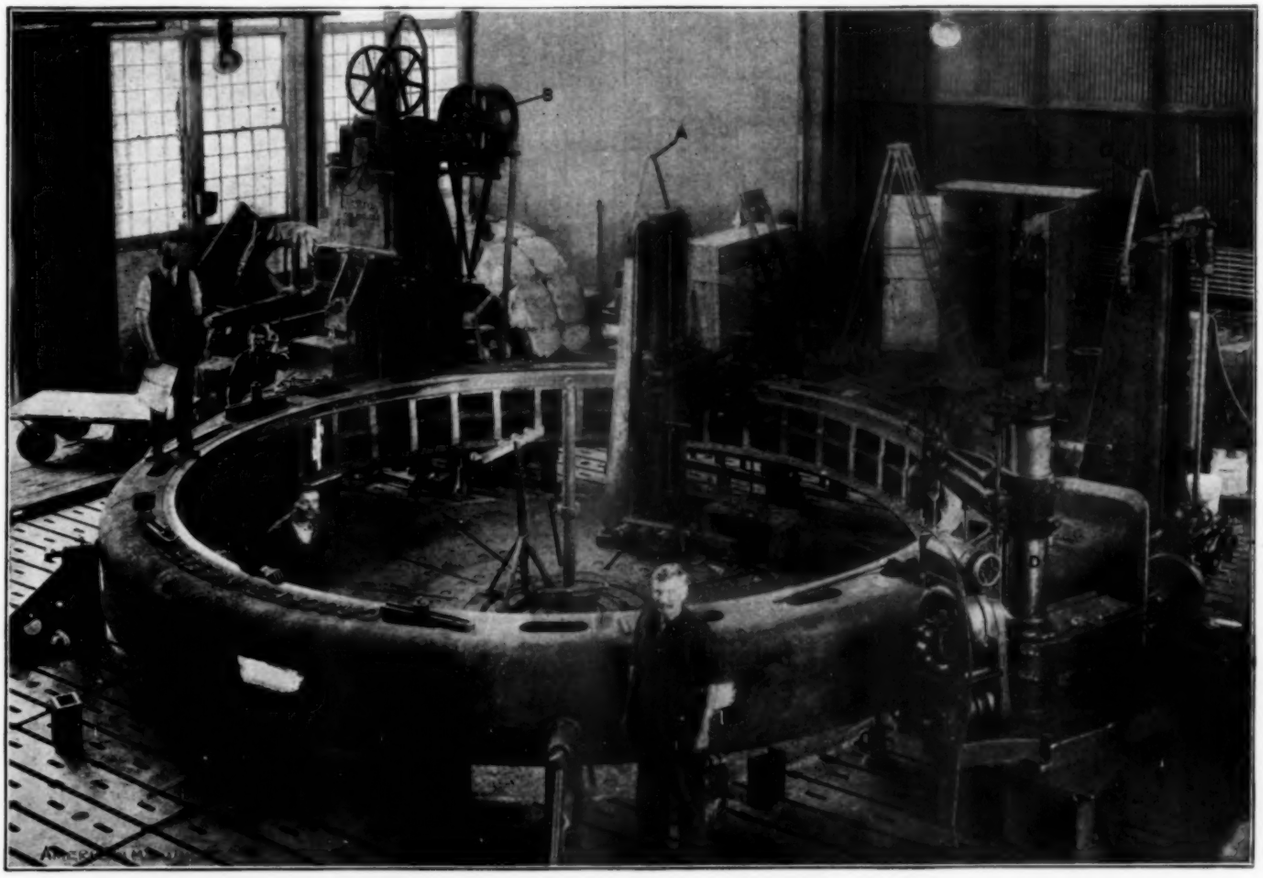


FIG. 1. GENERATOR FRAME SET UP ON FLOOR-PLATE MACHINE, WITH FOUR TOOLS OPERATING SIMULTANEOUSLY

This generator was constructed in 60 day's time which is somewhat of a record for a piece of work of such size and nature which ordinarily would consume from 4 to 5 months.

As will be noted four machines are working simultaneously. That shown at *A* is a boring tool which is rotated by the central floor-plate and bores out the inside surface of the frame. At *B* is a vertical planer engaged in facing off one of the feet of the frame while *C* shows a horizontal borer at work on one of the feet. At *D* is shown a radial driller drilling holes in the face of the frame. As will also be seen the various machines are provided with bales at the top by means of which the overhead traveling crane picks them up and transfers them to different points on the floor-plate. The entire floor of the building in which the floor-plate machine operates forms a huge platen, and as each of the tools is driven by its own individual motor they can readily be located at any desired point.

Of not the least interest in connection

with this generator frame is the main bearing construction which is shown in Fig. 2. Owing to the great weight of the rotating part, and the fact that it is direct connected to a horizontal water wheel, the main bearings are provided, as shown, with a journal box on the lower half of the bearing only, the upper half of the shaft remaining bare and protected only by a cover plate shown in the foreground. While this is somewhat of an unusual design it is adapted for

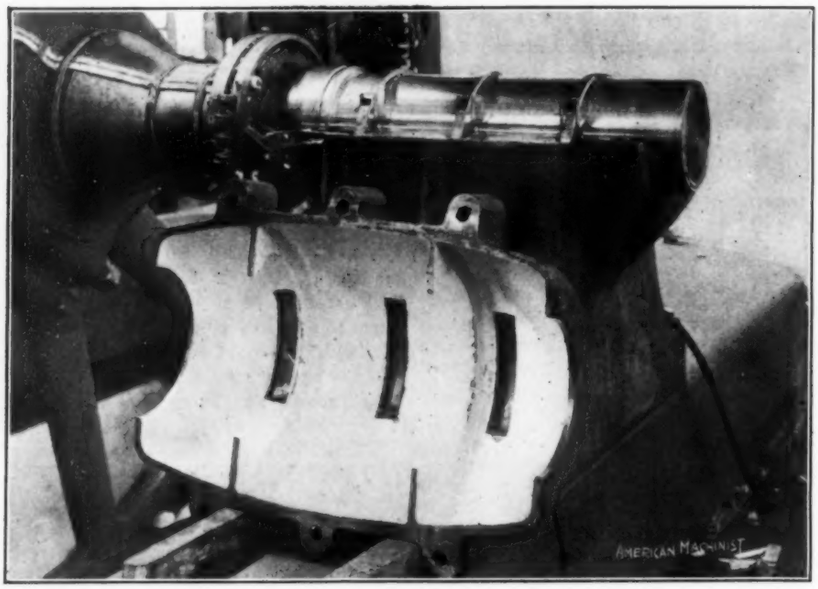


FIG. 2. LARGE BEARING OF ONE-HALF JOURNAL BOX CONSTRUCTION

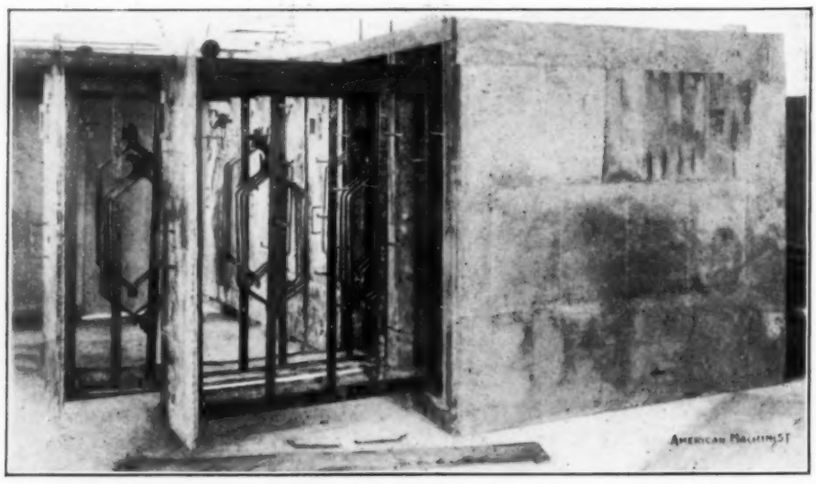


FIG. 3. OVEN IN WHICH THE BIG COILS ARE BAKED

the service intended and has in its favor decided economy. It will be noted that the bearing is provided with oil rings after the usual design.

The oven in which the form-wound coils of this generator are baked may be of interest and is illustrated in Fig. 3. The coils are hung on racks, impregnated with insulating material, after which the racks are rolled into the oven and the coils allowed to bake.

Fitting Crank and Wrist Pin Bearings

BY S. M. UDALE

The production of a large number of small-sized gasolene engines of 2, 3, 4 and 6 cylinders each, entails the use of special jigs to measure and obtain accurate alinement of those bearings. Obviously, the axes of the wrist and crank pins should be parallel and in the same plane. To restore, or obtain this condition, the shank of the connecting rod must be twisted to bring the axes to the same plane and bent to bring them parallel.

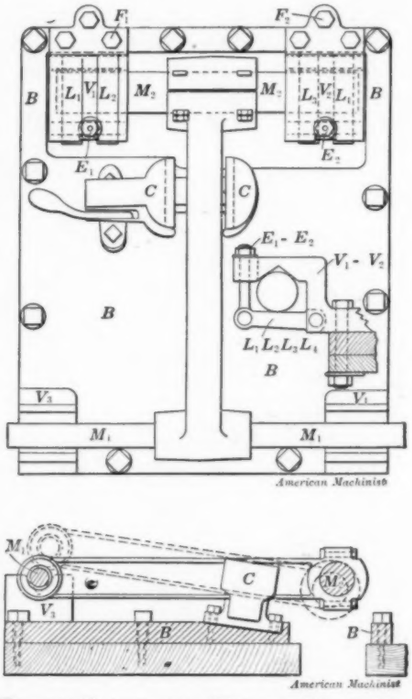
The economic conditions involved in large productions of cheap engines will not allow the delay or expense involved in fitting each crank-pin bearing in place.

The late delivery of a season's production can frequently be traced to delays caused by the adjustment of the bearings in factories where these adjustments have not been standardized.

The wrist pin is fitted first. All the pins should be ground to limit gages, then the wrist-pin bushing, if of steel, should be forced in and lapped to limit gages, allowing from 0.001 to 0.002-inch clearance. If of bronze the fitting is frequently done by hand scraping. Bronze bushings, however, are becoming obsolete, except for two-cycle engines, where more clearance can be given.

The babbitt bushings for the large end should then be fitted, after they have been consolidated by peening; this also drives the keys in.

They should then be reamed to size with 0.030-inch shims between the cap and the connecting rod. The edges near the joint should then be backed off 0.015



FITTING CRANK- AND WRIST-PIN BEARINGS

inch and short oil grooves cut. Finally, they are fitted to the mandrel and ground exactly to the size of all the crank pins. When a good bearing is obtained the mandrel should be clamped in suitable V-blocks, and a long mandrel placed through the wrist-pin end, also resting on the V-block. It will be then seen whether the axes are in the same plane or not.

To measure whether they be parallel or not, inside calipers, vernier or micrometer should be used.

The shank of the connecting rod should be clamped in a vise 1 inch below the big end, and twisting and bending applied through the wrist-pin mandrel until perfect alinement is obtained.

In the jig illustrated the wrist-pin mandrel *M* rests on V-blocks V_3 and V_4, which are cast integral with the cast-iron

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base B. The big-end mandrel M_2 is clamped to V-blocks V_1, V_2, bolted to the bed B.

The bearing of mandrel M can be tested with a thickness gage. To be in correct alinement, it should seat on both V_1 and V_2, or be an equal distance from seating on both. It is in the latter case that a thickness gage is used.

A vise C is bolted in an inclined position to the bed B, with the jaws ground to fit inside the I-section of the shank on the connecting rod. By loosening links E_1 and E_2 and clamping C, the connecting rod is ready for straining.

A hole must be made in the bench to allow M, and E_1 and E_2 to drop down and through while vise C clamps the shank of the connecting rod.

In the assembly of the jig everything depends on the care taken to lay out the holes for the bolts F, F_2 and the accuracy with which they are drilled.

It would not be necessary to strain every rod, and certain limited errors could be allowed. One man ought to be able to correct and test 50 connecting rods a day of nine hours, which provides for the production of a good big factory.

The casting should be fairly heavy as it has to resist considerable stress. It is a common defect in all measuring and inspecting devices that they are not rigid enough to withstand the rough usage to which they are put.

Cutting Oil Grooves in Gibs

The Bullard Machine Tool Company, Bridgeport, Conn., has a small planer rigged up, as shown in the halftone, for cutting the zigzag oil grooves in flat gibs.

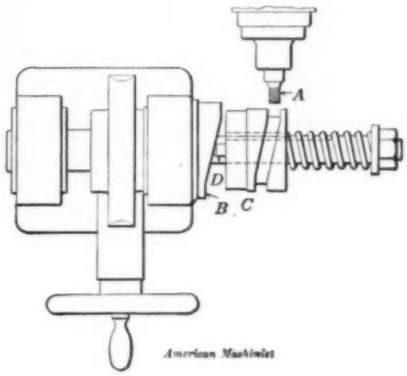
The bracket A carrying the rocking arm B, is placed on the cross-slide ways and clamped in place by setscrews; the rocking arm B is coupled to the tool carriage by the link C, the carriage, of course, being disconnected so as to be free to move back and forth on the ways; the rocking arm is given its motion through the connecting rod D and the block crank E, the stroke being regulated by adjusting the block to which the end of the connecting rod is fastened.

The tool used is similar to an ordinary narrow round-nosed tool, except that it is relieved rather abruptly back of the cutting edge, and as the planer table is reversed the tool is lifted by hand and dropped into place at the beginning of the groove as the table runs back.

Cam Cutting Fixture

BY CHAS. G. SMALL

There came to my attention recently what was to me a novel and ingenious fixture, used on a hand miller for cutting grooves in cylindrical cams, of small diameter and with a limited throw. As the fixture is used for only a limited number of pieces at a time, it has a hand feed, through a handwheel, worm and worm gear, to a work arbor. The accompanying cut is a plan view of the fixture and part of the spindle holding the cutter.



CAM-CUTTING FIXTURE

The fixture consists of a frame or head with two bearings, carrying the work arbor or spindle; this head is fastened to the table of the machine. To the front of the forward bearing a former plate or disk B is fastened, and doweled to the bearing to prevent it from rotating. The collar C is splined to the spindle to permit it to move longitudinally along the work arbor to the extent of the throw of the former plate; this collar carries the former pin D, which rests against the plate, and turns with the work arbor. The cam to be cut is put on up against the collar, and is splined and keyed to turn with the arbor. A good stout spring is now put on, of sufficient length to give a fairly even pressure during the entire travel of the cam along the holding arbor, and, finally, a nut and washer on the end of the spindle to hold the spring in place.

THE OPERATION OF THE FIXTURE

The operation of the fixture is as follows: The proper former plate is put in place over the work arbor, then the collar, the cam to be cut, and the other necessary parts. After all are fastened tight, and the proper cutter is in position in the driving spindle, the fixture is fed by cross adjustment, against the cutter till the required depth of groove is reached. The work is then fed around one turn by the handwheel, worm and worm gear, already mentioned, and, at the same time, travels back and forth on the arbor according to the throw of the former plate, against which the former pin is held by the pressure of the spring.

Mixture Used in Babbitting Bearings

BY S. KIRLIN

While visiting the power plant of the Anderson Traction Company recently, at Anderson, S. C., my attention was called to a little wrinkle in babbitting boxes.

Instead of using putty or clay for plugging up the ends of the boxes while the babbitt is being poured, some old asbestos pipe covering is ground up and mixed with cylinder oil to the consistency of a stiff putty. This mixture has these advantages: It is proof against the softening influence of heat, sticks far better to the box than either putty or clay, never "blows" when the hot metal comes in contact with it, and can be used over and over without loss or hardening.

CUTTING OIL GROOVES IN GIBS

It has been shown by accurate experiments in the laboratory that the flow of gasolene through a nozzle is 25 per cent. slower at winter temperatures. Because of this tendency, and because a richer mixture is called for than in summer, it may be necessary at the beginning of the cold season to have the carbureter adjusted by an expert.

Producing Threads by Dies or Rolls

By J. P. Brophy *

Practical points in the making and using of threading dies and rolls, with proportions for hobbing taps, methods of milling and adjusting dies and formulas for sizing threading rolls.

The difficulties encountered in making good dies, and how some undesirable features may be avoided.

Ways and means of determining proper allowances in stock diameters for threading with rolls. Two ways of applying the rolls to the work.

*Vice-president and general manager, Cleveland Automatic Machine Company.

The subject of producing threads has been discussed back and forth for nearly a generation, and at this time there are many important points in connection with this class of work and many things can be considered which will most likely be interesting. There is one thing certain, that if the general run of factories manufacturing machinery of all kinds attempted to produce threads that are what would be considered theoretically correct, they would have a monumental job on their hands, and there are many manufacturers who pay a vast amount of attention to producing duplicate work, but who fail to study this question of threads as closely as they should.

Variations in Threads

We can commence with tap and diemakers and discover that taps and dies will constantly vary more or less in both pitch and diameter. It makes no difference how particular the manufacturers of such tools may be, there are bound to be some discrepancies when figuring on correct sizes and angles for threads.

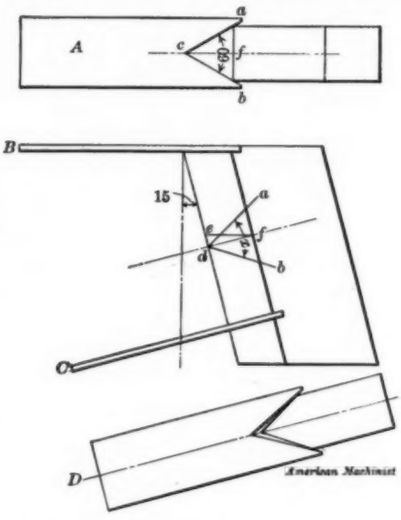
Another thing, in producing V-threads, it is rarely when measuring on the angles, which is the proper place to obtain the size, that the outside diameter will be under or over size. Either the angles are greater or less than they should be. There is no question but that any number of bolts and screws that are used for general purposes rarely fit along the angles of both sides.

I consider it one of the most difficult propositions in manufacturing to produce threads for general use on bolts, nuts and screws of all kinds and be sure of duplication. It requires the strictest attention from the very minute we start to make the hob taps for manufacturing threading dies of any kind. We all know that if a hob tap is not exactly right, the threads produced from such a hob tap will be wrong as long as the taps last. In the making of a hob tap it is absolutely necessary to be positive that the angles of the threads are correct; this point is vital. If the tap is not right, inaccuracies will be continued all the way through in the die making.

Also, manufacturers of dies of all kinds have ideas of their own concerning the length of thread for certain diameters and pitches. The length of lead or throat and the angle of throat vary more or less. Our practice is about 44 degrees and we obtain good results.

Cutting Edges of Dies

Some manufacturers of such tools figure that the cutting edges of dies should be in line with the center as in Fig. 1, and should be ground radially on the cutting surface. Others are under the impression that it is better to have the die cut ahead of the center. The supposition is that with threading dies, when milled ahead of the center, the cutting edge will cut slightly freer and produce better results than a die milled directly toward the center. I have had some experimenting done along these lines for some little time past and am satisfied, from the results of these tests, that all dies made with hob taps, milled in line with the center, using a milling cutter of 45 degrees angle, as in Fig. 1, which makes both sides of the mill cut in line with the center, produce somewhat better threads than a die milled ahead of the center. This shape of die also retains its form in hardening, the angles being equal.



(1) In Triangle a-c-b, Angle a-c-$b = 60°$, $af = cf \ tg \ 30°$.
(2) In Triangle a-d-b, $af = df \ tg \frac{x}{2}$.
(3) In Triangle e-f-d, $\frac{df}{ef} = cos \ 15° = \frac{df}{cf}$
(4) From 1 and 2 we get $tg \ 30° = \frac{df}{cf} \ tg \frac{x}{2}$

From 3 and 4 we get $\frac{tg \ 30°}{cos \ 15°} \ tg \frac{x}{2}$ $30° 52' 3''$

Angle $x = 61° 44' 6''$ or $1° 44' 6''$ Larger than Thread Angle.

FIG. 5. THREAD-TOOL DIAGRAM

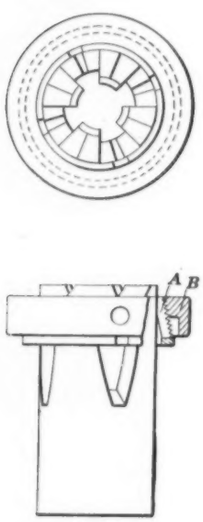


FIG. 1

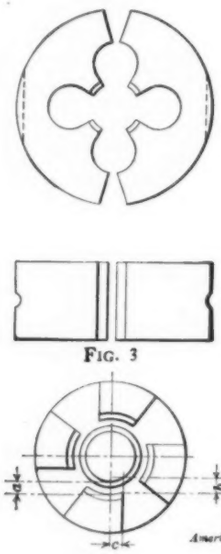


FIG. 2

FIG. 3

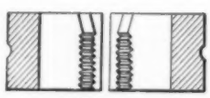


FIG. 4

SPRING AND BUTTON DIES

Also, if the cutting edge is ahead of the center as much as some tables show it should be, the die back of the cutting edge will come in contact with the thread produced as it passes along, and by the time the die reaches its destination and the thread is anywhere near correct as to depth, the die back of the cutting edge is crowding against the work, which means that it is not cutting freely for the reason that it has not the proper clearance.

Fig. 2 shows a diagram in which *c* is the full distance of the cutting edge ahead of the center, *a* is the hight of the thread back of the cutting edge and *b* is the hight of the cutting edge of the die. This diagram shows the difference between the spaces at *a* and *b* and proves that a die too far ahead of the center is not working satisfactorily, but a die slightly ahead of the center might not show this mechanical defect, and for this reason a die right on the center is, theoretically, nearer mechanically correct than one with the cutting edge in advance.

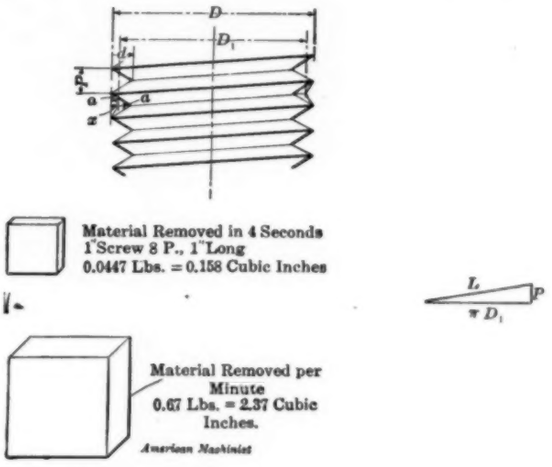


FIG. 6. METAL REMOVED BY THREADING DIES

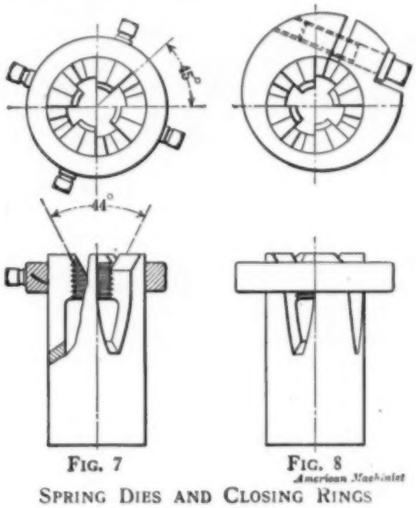


FIG. 7 FIG. 8

SPRING DIES AND CLOSING RINGS

ALLOWANCES IN HOB TAPS

One man, who thinks he understands the business, will make a ⅝-11 hob tap perhaps 1½ inches long, and the largest diameter of the tap will be say 0.005 inch greater than the smallest. In the above length another has a notion that it should be 0.010 to 0.015 inch, and still another will have the idea that the amount of thread standing on the inside of the die should be a certain width and length while the next man thinks differently. This means no standardization in die making. I am satisfied that the best general results can be obtained by making master taps thus: Dies from ⅛ to 7/16, about 0.004 taper to the inch; dies from 7/16 to 1 inch, about 0.006 taper to the inch.

In many instances in die manufacturing, especially with spring dies, the toolmaker will hob the die out so that it is 0.002 or 0.004 inch larger than the work for which it is intended for all sizes, closing it down after hardening to the correct diameter, thereby creating a clearance longitudinally. I am quite positive that with dies from 0 to ¼ inch the mouth of the die should be tapped about 0.005 over size; from ¼ to 7/16 inch, about 0.007; from 7/16 to ⅝ inch, about 0.008 and from ⅝ to 1 inch, from 0.010 to 0.012. This gives about the right clearance, and as there is great possibility, especially in spring dies, of the wings closing when being hardened, there is some come-and-go in adjustment to obtain the size. If the die loses its shape in hardening and opens up, the ring enveloping it can be relied upon to close down the cutting edges to the right diameter, but if they were tapped too close to size and closed in considerably, and were not tapped oversize to the extent mentioned above, there would be no adjustment toward the center.

AVOIDING DISTORTION

There is one important thing that should be considered in making a spring die; that is, the thickness of the wall where the thread is cut should be great enough, and the width of the portion of the spring die that stands up containing the thread should have section enough, even when the die is dull, so that it will not spring away in any direction. If it does, it is bound to distort and produce a very poor thread.

Another thing to be considered seriously is that no matter how accurately spring or button dies may be made, they are liable to lose their shape in hardening. The contraction of the metal when hardening is liable to destroy the accuracy obtained in the manufacture of the tool, and in many cases in order to produce an absolutely perfect thread as to angle and pitch, it is necessary to make several dies before one is obtained which gives accurate results.

Also, one may have all the best tools imaginable for producing first-class dies, and when such a die is placed in any kind of a machine it will produce a theoretically correct thread, but after the die becomes dull and the operator attempts to grind it, instead of having on a 4-lip die 12 cutting edges, allowing three threads back for throat, there is liable to be any number less cutting edges removing the material. The remaining cutting edges are ground away and are nothing more than a clearance. I will venture to say that 75 per cent. of the dies used in all shops are injured after the first grinding to the extent that there

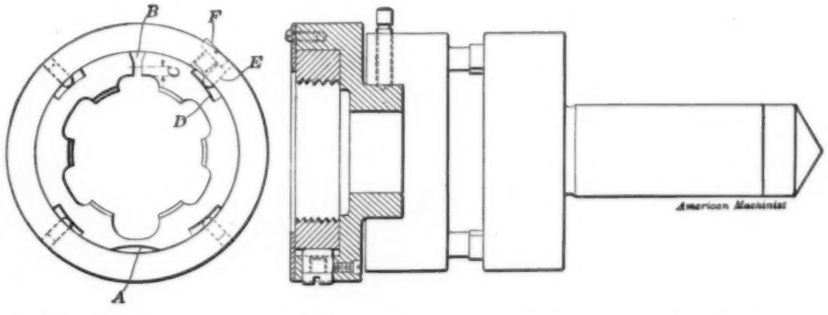


FIG. 9. A DIE THAT CLEARS ITSELF WHEN WITHDRAWING FROM THE THREAD

is only a chance of their ever being accurate again. It is one of the most difficult things in a factory to keep thread-cutting dies in first-class shape and it is a question that in many cases is not given the consideration it deserves as regards grinding, etc. A die on which all the cutting edges are removing the right amount of material will last longer than a die that is made up or ground in such a manner that only a few of the teeth actually are doing the work.

Button Dies

There is no doubt that a button die in two pieces, like Fig. 3, is a more satisfactory tool than one split on one side as in Fig. 4. All the cutting edges are then being closed in toward the center in nearly the correct way on the 2-piece die, whereas when it hinges on one side, as soon as it is closed it loses its shape and then the threads are nowhere near the right shape.

The one important point in connection with button dies in two pieces is that the cutting edges can be ground so much nearer correct than if in one piece. A simple fixture can be made to gage from the cutting edges when grinding the throat, and after one-half is ground, the other half can be placed in position, and this can be continued. By handling the die two or three times under the wheel, we will then have the same angle and the same depth of throat, thereby giving a shape nearer correct than is possible by grinding the die in any other manner and producing a thread with all the cutting edges doing their work equally.

The practice in manufacturing button dies to have cutting edges on both sides is, in my estimation, far from correct. In order to have the clearance back of the cutting edges, the best we can do is tap the die out parallel if we are going to cut from both sides, because if we use a hob tap from both sides, we have the high point in the center and the results cannot be satisfactory. It is done, of course, with the idea of obtaining double the amount of life from the die, because of the difficulty in grinding the cutting edges and on account of the die being narrow, but a button die made theoretically correct should have a cutting edge on one side only, using the same kind of hob tap as is used for spring dies. We then obtain a free cutting die because the clearance is where it belongs.

Lathe Thread Tools

In the chasing of threads in a lathe, either on taps or for general work, the lathe hands are liable to make a mistake in grinding the tool that produces the thread. Fig. 5 shows a thread tool with a clearance of 15 deg. In many instances the mechanic doing the job is liable to place the gage at right angles to the line of clearance (as at *C*), instead of having it parallel with the top cutting edge *B*, which naturally would be in direct line to the center of the work. If the tool is raised considerably above the center, the angle changes to a great extent. The same thing occurs when the die is cutting ahead of the center.

On this drawing it will be noticed that if the gage is held in the wrong position, the angle of the triangle is changed 1 deg. 44 min. (see *D*, Fig. 5), which means that the altitude of the triangle is lowered. Then we are producing a thread that certainly is not correct. It is an error which is apt to creep in in the general run of machine shops without receiving much consideration. The tool is merely sunk in until the threaded part will fit a gage or nut, and then it is considered a good job, whereas the real bearing on the sides is only a line of contact.

The Die as a Remover of Metal

Considering its shape, there is no tool that removes as much material in a given time as a die. In the diagram, Fig. 6, we are considering a 1-inch 8 V-thread. In eight turns of the bar in four seconds, figured from the line of the center of gravity, we have 23.339 inches length of chip removed, which is in section an equilateral triangle ⅛ inch on the sides. The figures are given here merely to call the attention of interested readers to what occurs in producing a thread on a 1-inch bar 8 pitch; something which undoubtedly very few would give much consideration. We also show the amount of material removed in four seconds when cutting a 1-inch 8 thread, in cube form, and its quantity in figures. The amount removed in one minute is also shown in cube form, and the amount it contains in figures.

Adjusting Rings for Dies

Fig. 7 shows a plain ring with four screws for adjusting the cutting jaws. Common practice is to place the gage in the die and bring the jaws down so that they just touch. Even after doing this and the die commences to produce threads, it is liable to cut freely or otherwise and the size cannot be depended upon. For this reason it is necessary to adjust the screws a small amount. Then the cutting edges are disturbed once more and great care should be exercised in such adjustment.

Fig. 8 shows an eccentric ring for the same purpose, closing in the die. It is quite satisfactory if the metal is distributed all around so that when the ring is closed, say 1/32 inch, it is still a true circle. If it is too heavy or too light on the thin side, it is liable to lose its shape just as much as the die Fig. 7 by the adjustment of the screws. Fig. 8, when the screw is tightened, swings the two heaviest sides toward the center, and the ring all around should yield as much as the heavy side closes toward the center in order to close in equally all around. Otherwise, if an eccentric ring is made in a careless manner without paying attention to these points, it is no better than the ordinary ring commonly used today. Even the counterbored side where the head of the screw rests is weakened, allowing the section where the screw comes against the die to tip over more than the opposite side. It will be seen from this explanation that I have not much faith in a ring of this kind if it is not carefully constructed.

In Fig. 1, *A* shows a ring that fits over a spring die, and which is split four times, the outside being tapered and threaded. The outside ring *B* is threaded

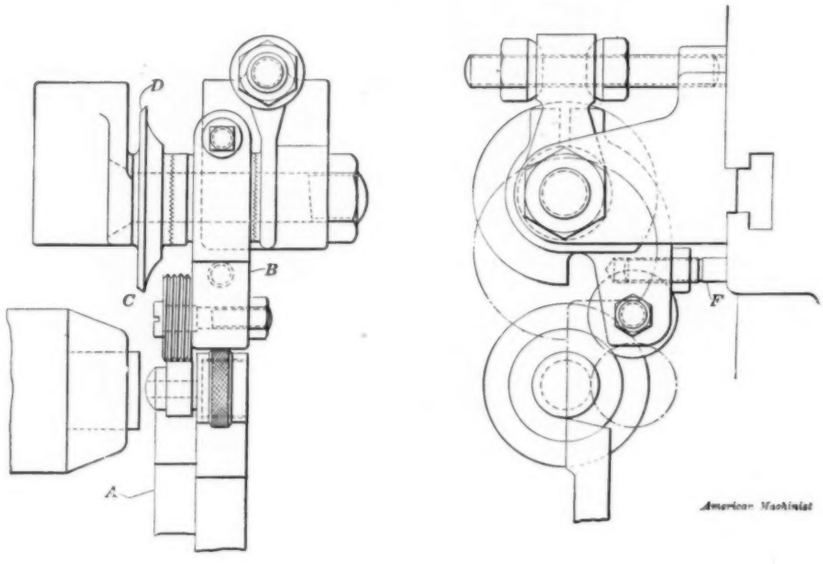


Fig. 10. Thread-rolling Attachment

on the inside and as this ring is tightened down, the split sections of *A* close against the die evenly all around, which makes a very satisfactory adjustment for spring dies, although somewhat more costly than other styles of rings generally used for this purpose.

Other Types of Dies

Fig. 9 shows a die that works quite satisfactorily and is well adapted for large threads. It comes nearer the self-opening die than any other design I am aware of. The die is made and milled out at *A* to weaken it on the one side so it will spring easily when in action. The opposite side *B* is a V-shape, milled part way down and is left in this form until hardened. Then with an emery wheel at high speed the slot *C* is ground through, separating the die at one side. This die is made slightly larger than the work so that it passes over it freely. *D* shows a cam form and *E* a hardened pin resting against it. *F* is a screw with the head pressed against the hardened pin. After the die is set to size and the pin is at the highest point of the cam, it is ready for business. When it comes against the work, the pin is resting on the high side and after the die reaches its destination and reverses, the friction of the die on the part it is threading turns it around and releases it from the highest point of the cam to the lowest, thereby giving freedom between the work and die so that the die has no tendency to tear the thread in reversing.

It must be admitted that after one has said all that is possible concerning the producing of threads, the self-opening die, generally speaking, produces the most satisfactory thread, because the dies themselves, as they are individual cutters, are easily handled in a simple fixture for grinding accurately. Also, considering that their clearance in all directions is more satisfactory and that they are enveloped in a solid case and held rigidly in position, the results are bound to be almost ideal.

The point arises right here that the cost of self-opening dies alarms many manufacturers, but if we consider the matter seriously, it will be found that the chasers, after once we have the die head, are really not much more costly than spring and button dies of today, and they will last longer, and if one has a number of threads of various sizes to produce, it is a good-paying proposition to consider earnestly the advisability of using self-opening dies for the general run of standard threads.

Thread Rolling

The rolling of threads is not universally practised for the reason that it is somewhat more difficult to make up the rolls for the job than to use ordinary dies for this purpose. The roll should be accurately spaced and the angles and diameters should be theoretically correct. The holder for the roll should, in all cases, be true so that when the roll is in position it will stand perfectly vertical and parallel with the machine. Thread rolling is considered more seriously when making parts with most of the operations on the opposite end from the thread and especially so if the threading is the last and only operation to complete the piece. It does away with second handling and does not consume a great amount of time and is better adapted in all cases to diameters from the small up to ¾ inch (See Figs. 10 and 11).

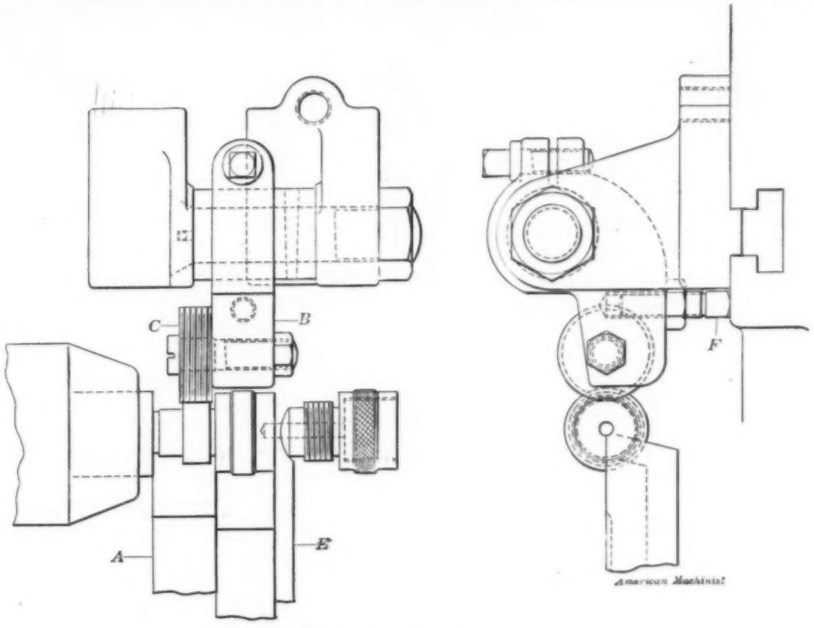


Fig. 11. Thread-rolling Attachment

In making thread rolls, the size of the hole in the roll should be considered very seriously, and it is much better to support the roll on two sides, rather than overhanging. If the roll is 1 inch in diameter with a ½-inch hole in it, good results would not be obtained for the reason that there would be too much friction in the hole and the trouble would be that the roll would hesitate, in other words, not revolve steadily. If the roll hesitates, it is liable to crawl and destroy the thread. It must be kept constantly revolving the same as two gears meshed together. The roll has only a slight tendency to crowd sideways if the diameters are correct and also the part on which it is threading is parallel.

Surface of Contact

The difference between the contact surface of rolls with ½-inch and ⅜-inch holes is ⅓. That is to say, a ½-inch hole has ⅓ more surface contact than a ⅜-inch. In producing a thread, say ½-12, if the roll is double the size of the thread you are producing, then a hole about 5/16 inch is plenty large enough. The idea is to have a hole in the roll just large enough so that the pin will not shear off. It would be better, if possible, in all cases to have ball bearings inside of the rolls when producing threads, thereby practically doing away with all friction.

Another question which is of importance in thread rolling is the kind of material on which we are producing a thread. We can roll threads on copper, brass or steel. The density or hardness of different metals means a change in the diameter before the threading takes place. The diameter of blank for certain sizes and pitches is given in the formula below, but cannot be depended upon for a certainty. The metal does not flow as easily when producing threads on hard stock as on softer material. The difference in pitches also naturally changes the diameter of the blank.

Action of the Metal

Figs. 12, 13, 14, 15 show what occurs in thread rolling, giving the position of the roll in four different depths. Without giving the matter serious consideration, the supposition would be that when the roll comes in contact with the blank and is crowded into it, the raising of the thread above the surface would take place from the center rather than from the sides, but it will be seen that the stock rises from the sides gradually and folds itself into a triangular form, and when the thread is complete and closed up tightly, one will have to look closely before he discovers that there are two perpendicular walls down the center of the triangle, crowded close together, instead of a solid.

The thread-rolling attachment can be applied in two different ways:

First, with the roll passing under the work, Fig. 10; second, with the roll

pressed against the work, Fig. 11. In Fig. 10, *B* is the thread-roll carrier with roll *C*. The roll passes under the work and should not be pulled back before the piece is cut off, and therefore we follow up with cut-off tool *D*.

In Fig. 11 the roll is pressed against the work and the cutting off is done with tool *E*, after feeding out the stock and while the next piece is formed.

The thread-rolling attachment should advance at a moderate speed so as to shape. If the roll is moved in too fast, the thread on the screw will be brittle and be destroyed in starting. The roll is adjustable up or down by screw *F*.

Approximate Formulas

For thread rolling the screw blank should be smaller than the outside diameter of the finished screw. The reason for this is that the material of the screw will crowd upward between the threads on the roll.

An approximate formula to figure the diameter of the screw blank is as follows:

For sharp V-thread

$$d_1 = \sqrt{0.25\left(\frac{1}{p}\right)^2 + d^2}.$$

For United States Standard thread

$$d_1 = \sqrt{0.2112\left(\frac{1}{p}\right)^2 + d^2}.$$

in which

d_1 = Diameter of screw blank;
d = Pitch diameter of thread;
p = Number of threads per inch.

SCREWS WITH V THREAD

V Thr.	Pitch	O.D. Screw	O.D. Blank	Undersize
¼″	20	0.25	0.208	0.042
⅜″	14	0.4375	0.3777	0.0598
¾″	10	0.75	0.6649	0.0851

Allowances Determined by Experient

The exact amount of material which will appear above the diameter of the blank depends on the shape of the thread and the softness of the material, and should be determined experimentally by making a sample.

In order to be on the safe side we leave the forming tool *A* on the cross slide somewhat large, and thereby get a screw blank which is slightly too small, and the thread will show a flat at the top. Then, by pulling the forming tool back or by grinding it off, we arrive at the correct proportion.

Roll Diameters

The diameter of the roll can be accurately determined by the following formula:

$$D = (d - p) \times N,$$

in which

D = Outside diameter of roll;
d = Outside diameter of finished screw;
P = Pitch of screw thread in inches;
N = Number of starts of thread on roll.

The selection of N determines the size of the roll. In the above example $N = 2$ would give a roll which would be too small, but $N = 4$ might give a better diameter.

The sample shown in the illustration (Fig. 10) is a ⅝-inch screw, 14 thread, right hand and the outside diameter of the roll will be:

$D = (0.625 - 0.0714)\ 2 = 1.107$ *inches.*

Size of Thread	No. of Threads per Inch	Outside Diameter Roll	Thread on Roll
¼	24	0.833	quadruple
⅜	30	0.8376	triple
⅛	24	1.187	triple

Roll Details

The threads on the roll closest to the sides should be flattened. If this is not done, they might break because of the side strains on the inside only. The roll should overlap the part of the screw to be threaded. This means, that if possible, the screw blank should be necked. The threads on the roll should be cut in the opposite direction to those on the screw.

Others may have different notions on many things explained in this article, but my experience has been as near along these lines as it is possible to describe.

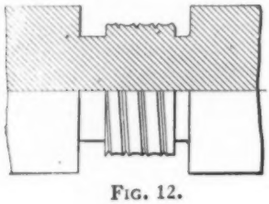


Fig. 12.

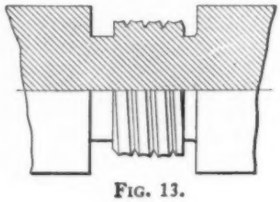


Fig. 13.

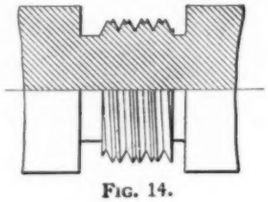


Fig. 14.

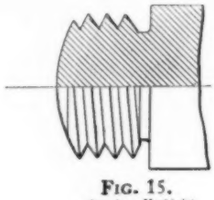


Fig. 15.

Action of the Metal under Thread Rolls

Locomotive Frame Breakage

Among the interesting points brought out by the committee on locomotive-frame construction at the annual convention of the American Railway Master Mechanics' Association were:

The adoption of the Walschaert for other outside valve gear has helped to overcome frame breakage on account of allowing additional bracing and stronger frames.

Setting valves so as to reduce compression has also been found helpful on some roads.

Few breakages are reported in less than two years from the time engine was built, but after that they become more frequent as the age increases. Cast-steel frames seem to be less reliable than forged frames, some of the latter running four to eight years before giving trouble. There seems to be no particular type of engine giving more trouble than others, with the exception that a few failures are reported in the eight-wheel or American type.

One road reports that 39 per cent. of the engines passing through the shop for general repairs had broken frames, which had to be welded. In contrast to this is a report from an English railroad having over 1500 engines with slab frames, where the breakages ran a little over 10 per cent. These frames are now welded with oxyacetylene, or some similar process, which has greatly reduced the time of repair. The use of the various welding processes in connection with this class of work is rapidly becoming universal.

Another road gives the life of a forged wrought-iron frame as 5.9 years, as compared with 5.5 years for cast steel and states that on account of difficulty in securing homogeneous metals uniformly annealed, they prefer wrought iron.

Exports for the ten months ending with April, 1911, show the following figures under the iron and steel classification: Exports of typewriters in the 10 months under review amounted to 8 million dollars, against 5½ million in the corresponding period two years ago; sewing machines over 7 million, against less than 5 million in the same months of 1909; metal-working machinery, nearly 8 million, against 3 million in the corresponding period two years ago; electrical machinery, 6½ million, against 5¼ million in the like period two years ago; locomotives, 3½ million; stationary engines, 3¼ million; traction engines, nearly 3 million; and other engines and parts thereof, 3½ million.

Press Tools for Beading Tin Cans

By M. Martin

A die for use in either foot or power machine for obtaining a "French" bead. Details of a punch and die operation whereby troublesome "misfits" and wrinkles are eliminated and rapid production obtained.

I was recently confronted with the proposition of putting what is called "French bead" on irregularly shaped tin cans, such as are used for cocoa, spices, etc. The "bead" consists of the open end of the can being compressed so that when the cover is put on, both walls of the body and cover will be "flush," leaving no projecting surfaces, so as to allow for easy and perfect labeling, etc.

Not have a squeezing machine to do this, and not caring to stamp the bodies on account of the possibility of their not running through the automatic body former, I designed a die for use in either foot or power press that made a first-class job, and insured a uniform fit for the cover.

Fig. 1 is the regular can body as it comes from the automatic body former, and Fig. 2 is the same with the "bead."

Fig. 3 shows the front and side view

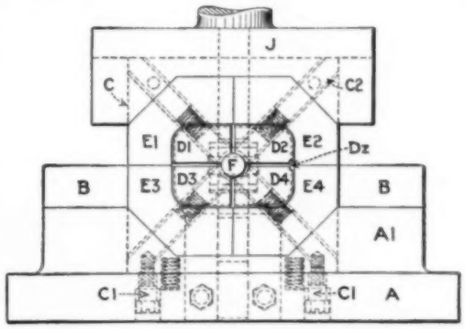
THE BOX

of the die firmly locked, everything down, and can being squeezed.

A is a cast-iron shoe or bolster with a slot milled or machined through endways to hold the guide blocks *B*, which are fastened by screws and dowels in position so that the squeezing plate *C* can slide easily. This bolster *A* is further machined so that the front ledge *A* 1 is much lower than rear ledge *A* 2, and has two 45-degree contracting surfaces that act in squeezing the can.

B are two cast-iron guide blocks that fit into slot in *A*, and as before stated, insure squeezing.

C is the "squeezing plate," also made of cast iron, machined absolutely square and slides nicely between the ledges *A* 1 and *A* 2 and the guide blocks *B*. It is held in position by two shoulder screws *C* 1 through the base of *A*, which allow for ¼-inch upward movement only. Several springs, contained in pockets (not shown) in both *A* and the base of *C* in the space between the ledges *A* 1 and *A* 2 and guide blocks *B*, always hold this plate *C* up when the die is not in action, to allow the other parts to act or open. This plate *C* is machined square, and has T-slots *G*2 milled diagonally across the front face, which will answer the double purpose of holding the expanding and contracting jaws and insuring a proper guide. A 5/16-inch hole is drilled exactly in the center for the expanding plunger *F*.



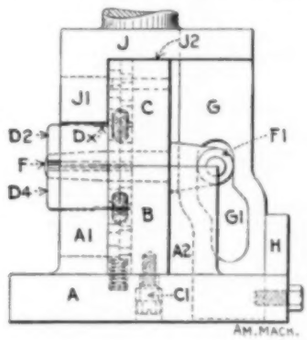


FIG. 3. THE DIE

D 1, 2, 3 and 4 are the expanding tool-steel jaws. These are originally machined in one block and have a taper hole exactly in center. These are milled on the base to fit the T-slot, *C* 2 in the plate *C*. The outside is also milled to the exact shape and size of the inside of the can body and has a depressed shoulder 5/16 inch wide around the end against the face of *C*, as at *Dx*, which will make the "bead." Provision is made in one of the sides or ends to take the lock seam of the can at *Dz*, after which the block is cut into quarters with a 1/16-inch slitting cutter, which provides ample space in collapsing or contracting after the plunger has been withdrawn to allow for the removal of the can body.

E 1, 2, 3 and 4 are the *squeezing* jaws, also made of tool steel. These, of necessity, are made in quarters from the start, and are machined at the base with the same T's to fit the T-slot *C* 2 in the plate *C*, and must be a nice sliding fit. These jaws are then fastened to the plate *C* and accurately milled on the inside to the exact shape of the outside of can body, leaving a projecting ledge 5/16 inch from the face of the plate *C*, which matches the depressed shoulder on the jaws *D* 1, 2, 3 and 4, and known as *Dx*. These jaws are then finished on the outside and after the corners are milled at 45 degrees to insure compression or squeezing, are hardened.

F is the expanding plunger or wedge and is made of tool steel, square stock being used. The shank is turned and ground to fit the 5/16-inch hole in the plate *C*, a nice sliding fit and the tapered end that enters the jaws *D* 1, 2, 3 and 4, and is ground to fit accurately. The back end or shoulder is faced so that when plunger is forced into the jaws, *D* 1, 2, 3 and 4 and against the back of the plate *C*, these jaws are expanded to the correct size. This end is then slotted and has a roller *F* 1 fitted.

G is a tool-steel cam, fastened to the punch *J*. The slot *G* 1, in which the roller *F* 1 travels, is milled in this and allowing 3/8-inch forward action of the plunger *F*. The cam *G* is held in position by a slot in the bolster *A* and has a guide plate *H*, so that it cannot bend outward. The guide plate *H* is fastened to the bolster *A* with screws.

J is the punch made of cast iron. This has a front ledge *J* 1 similar to that on the bolster *A* 1, with two 45-degree sliding surfaces. Behind this ledge there is the face *J* 2, which comes in contact with the upper surface of the square plate *C* and compels a uniform action in the operation of squeezing. There are dowel-pin holes through this ledge *J* 2, which connect with two similar holes in the top face of the squeezing plate *C*. These are used in setting the die and punch only.

The appearance of the die when open is as follows: The punch is up. The plate *C* is forced by the springs ¼ inch from the base and as far as the shoulder screws will allow it. The plate *C* being in this position, this allows the two lower squeezing jaws *E* 3 and 4 to expand or open. The two upper jaws *E* 1 and 2 are also open and against the stop pins in the T-slot *C* 2. The cam *G*, which is attached to the punch *J*, has pulled back

the plunger *F* by the action of the roller *F* 1 in the slot, which in turn allows the four expanding jaws *D* 1, 2, 3 and 4 to contract or collapse. On account of this collapsing and expansion of the jaws *D* 1, 2, 3 and 4 and the jaws *E* 1, 2, 3 and 4, a spring is held in pockets between each pair, *E* 1 and *D* 1, operating in the T-slot and below the face of the squeezing plate *C*.

The Mechanical Action of the Die and Punch in Operation

The can body is pushed over the collapsed jaws *D* 1, 2, 3 and 4 and against the face of the squeezing plate *C*, which acts also as a stop or gage. On the descent of the punch *J*, the roller of the plunger *F* travels in the slot in wedge *G*, which immediately forces the taper end of the plunger *F* into the collapsed jaws *D* 1, 2, 3 and 4 and forces them apart to the exact size of the can body, and then remains in that position for the balance of the squeezing action. The ledge of the punch *J* 1 in the descent then engages the jaws *E* 1 and 2 and forces them to contract by sliding down the T-slot and the 45-degree face. The face of the punch *J* 2 then engages the top face of squeezing plate *C* and forces this plate downward. In this movement the jaws *E* 3 and 4 are then compelled to contract in the same manner as *E* 1 and 2 and finally, when the downward action is finished, all the parts bottom and reverse action takes place along the lines before described. The can body is removed easily.

The squeezed edge of the can body is absolutely uniform with no sign of a wrinkle anywhere.

A crank press with 1½-inch stroke was used and from the above description will be seen to have been efficient.

Gun Carriage Hub Methods and Tools

By M. E. Hoag

Forging and machining operations used at the Rock Island arsenal. A finished forging in five operations. Some special small tools designed for economical and rapid work.

Through the courtesy of the Chief of Ordnance, of the United States Army, and the commanding officer of the arsenal at Rock Island, Ill., I am enabled to present this article to the readers of the American Machinist. I wish also to express my appreciation of the courtesies extended to me by Major King; and my thanks to the department foremen whose aid was given me.

In the shops at the Rock Island arsenal are to be found some very interesting and difficult machining operations, some of which were described by F. A. Stanley some years ago in the American Machinist; others have been described by foremen in the shops; and the treating of steels as practised there is being well handled by C. U. Scott, foreman of the tool-hardening department.

I will confine myself to the description of a few special tools and fixtures,

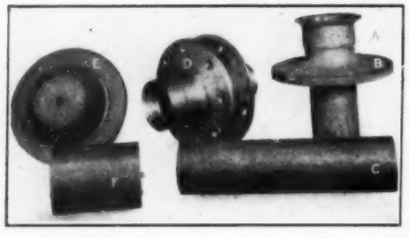


Fig. 1. Hubs and Hub Rings

and forging and machining operations found in shop G.

Forging and Machining Hubs and Hub Liners for Gun Carriages

The hubs and hub rings shown in Fig. 1 are used on the 6-inch Howitzer service carriage, and as those on the 3-nch and 4.7-inch field guns are practically the same, a description of one will do for all.

The rough stock for the hub is shown at *C*, and just back of it the finished forging which is completed in five operations in a hydraulic forging press.

In forming the rim *B* part of the stock is received in the lower die and part in the upper, which leaves both ends straight, with the rim formed to size, but flat on both sides. By again placing the stock under the dies, after dropping a ring over the end of the hub, a depression is formed in one side of the ring, which is not shown in the illustration.

In forming the short end of the hub a split-ring die is dropped over the end of the forging and the piercing die entered, which partly opens the hub, and insures perfect filling of the dies.

The stock and finished forging for the hub ring are shown at *E* and *F*. This piece is finished in four operations.

After forging, the hubs are drilled and sent to the Niles rigid-turret lathe shown in Fig. 2 and bored, after which they are finished in an engine lathe.

In Fig. 2 is shown a hub chucked and bored, with the tools used. The first boring bar is shown at *A;* the second one is hidden by the turret; the third tool *B* is fitted with four inserted blades which rough out the hole for the taper, and it is followed by the first roughing reamer *C*, and this by the second roughing reamer *D* which completes the taper. The spiral-fluted reamer *E* is then entered

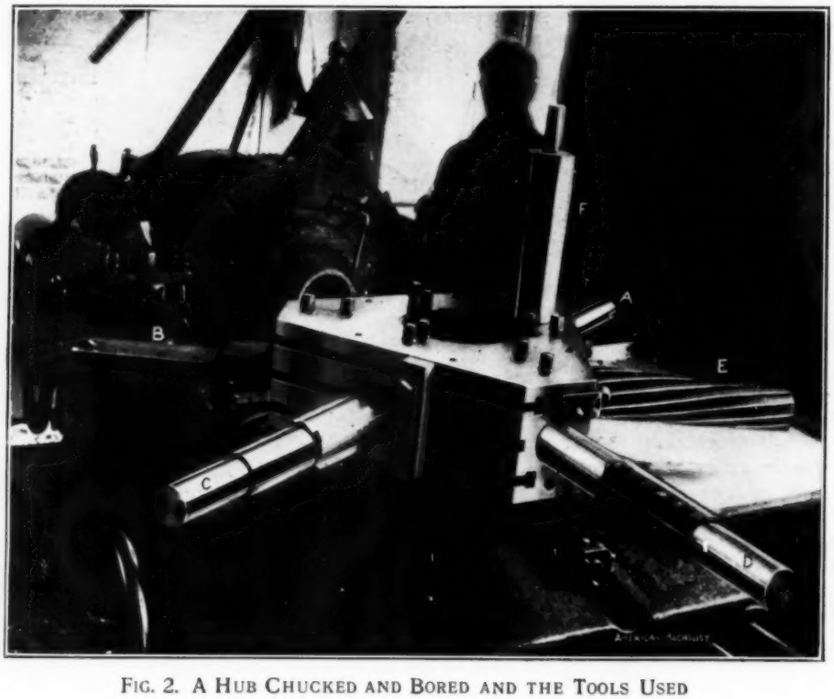


Fig. 2. A Hub Chucked and Bored and the Tools Used

which reams the hole to the gage shown at *F*.

A brass liner is pressed into these hubs so that when worn they may be renewed at slight cost. This necessitates very close limits on the bore of the hub, and the outside taper of the liners. In machining these liners they are first bored and reamed, and then placed in the miller and finished at one operation as shown in Fig. 3. The tools shown at *D*, *E* and *F*, cut the liner to length, turn the fillet *G*, and size the rim at the large end. These are followed by the roughing and finishing tools *B* and *C*, which complete the piece. It will be noticed that these last tools are set at an angle so that but a small part is in contact with the work at a time, and the metal is removed by a shaving cut which takes the stock off in a long thin ribbon.

With this rig it was found possible to complete one hundred pieces a day. By taking the roughing and finishing cuts at separate operations better results were obtained as to limits, but the time was not so good on account of the extra handling of the pieces.

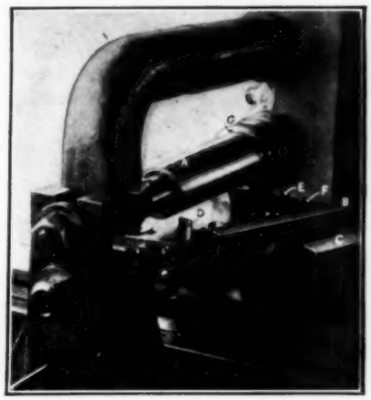


FIG. 3. FINISHING THE BRASS LINER

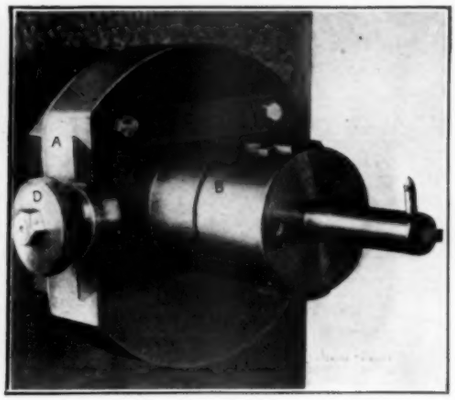


FIG. 4. A BORING TOOL HOLDER

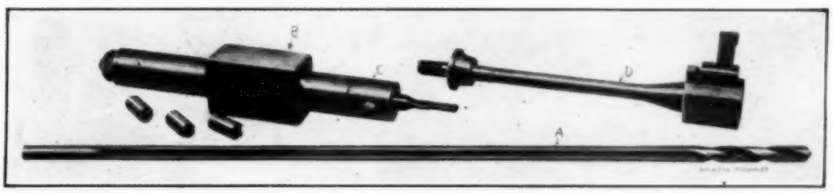


FIG. 5. SLOTTER TOOL

A BORING-TOOL HOLDER FOR THE MILLER

In Fig. 4 is shown a heavy boring-tool holder in use on a Cincinnati miller. The body *A* screws onto the spindle of the machine. The tool is held by the drill chuck *D* which is mounted in the slide *E*. By tightening the bolts in the gib *C*, this slide is held rigidly in position while the tool is in operation. The adjusting nut *D* is graduated to read in thousandths of an inch, so that very close adjustment of the tool is possible; a feature that will be readily appreciated, especially by toolmakers.

SOME SPECIAL SMALL TOOLS

The axles for gun carriages as made at this arsenal are hollow, and as the core is bored out it is necessary to use some long oil drills, which were formerly bought from the manufacturers at a cost of about $25 each, and were a big item of expense, especially as breakage was not of infrequent occurrence. The drill shown at *A*, Fig. 5, was gotten up to replace them, and it has proved very satisfactory in service, besides costing about one-fifth as much.

In making this drill a short, standard Pratt & Whitney oil drill is electric welded to the hollow shank, as shown in the halftone. This shank is made from steel tubing by swaging in special dies. Some difficulty was at first experienced in getting the proper shape, but it was found that by first squaring the stock it could be swaged to shape without trouble. The shank is made small enough to clear the hole without any turning or finish at all.

A HANDY SLOTTER TOOL

A very handy slotter tool is shown at *B*, Fig. 5, with bushings for different-sized tool shanks, and a graduated head. *D* is another tool head that goes into the same holder. In this head the tool block is pivoted and provided with a spring which holds the tool to cutting position, but allows it to release and prevent drag on the return stroke.

The special tools described in this article are largely the design of Alfred La Mar, shop foreman.

A Miller Problem

BY HENRY R. BOWMAN

I had occasion to mill three holes for gear-shaft centers in a plate, two of the holes being in alinement with the base and the third at unequal distances from the other two, the three centers forming an oblique triangle.

The two upper holes can be milled at one setting of the miller table, but the table must be lowered in order to bring the work into position for the third hole. The problem, therefore, is to find the exact distance to lower the table.

This being a problem which regularly presented itself in varying sizes, I finally devised the inclosed diagram, Fig. 1, of which I had blueprints made, and hung one at the miller, where it is right at hand when occasion requires.

It is so concise and simple that any ordinary machinist can work it out.

It will also be handy in other cases,

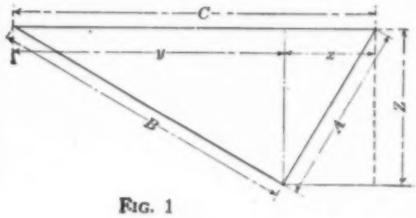


FIG. 1

$$y = \frac{\frac{(B+A)(B-A)}{C}}{2} + C \qquad x = C - y$$

$$Z = \sqrt{B^2 - y^2}$$

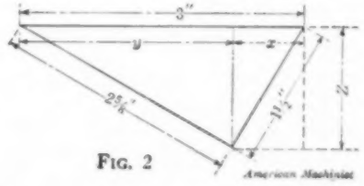


FIG. 2

and is a useful addition to a draftsman's set of tables.

To illustrate with a specific example, refer to Fig. 2, and let $A = 1\frac{1}{2}$, $B = 2\frac{5}{8}$ and $C = 3$ inches.

Then

$$y = \frac{\frac{(2\frac{5}{8} + 1\frac{1}{2})(2\frac{5}{8} - 1\frac{1}{2})}{3} + 3}{2} = \frac{\frac{4\frac{1}{8} \times 1\frac{1}{8}}{3} + 3}{2} = 2.2734;$$

$$z = \sqrt{2\frac{5}{8}^2 - 2.2734} = \sqrt{6.8906 - 5.1683} = \sqrt{1.722} = 1.312 \text{ inches.}$$

When $A = B$, $x = y$ and $y = C \div 2$.

Mandrels for babbitting large bearings are frequently made of wood and covered with a thin sheet of asbestos, which, if the bearings have to be bored out, answer just as well and are more easily handled than steel or iron ones.

Machining an Inlet Tube for a Cream Separator on an Automatic Machine

By A. B. L. Mann

The illustrations show the first and second operations for machining the inlet tube on a Potter & Johnston antomatic machine. The tube must be accurate, true and smooth.

First Operation

Fig. 1 shows how the tube is held in the chuck. Fig. 2 shows how the tools are placed in the turret and their position.

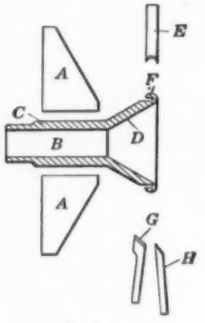


Fig. 1

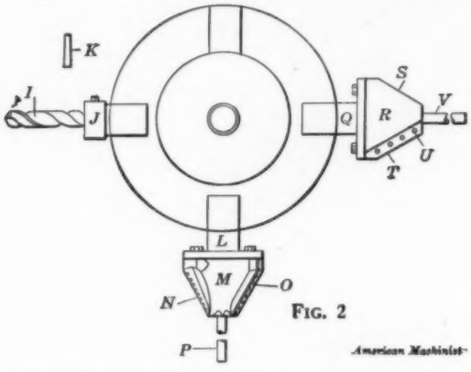


Fig. 2

First Operation on the Tube

Fig. 6 shows a side view of the former. Fig. 7 is the turret with tools.

The tube being held and gripped on *A* with the bushing *B* fitting into the spindle, (to prevent the bell shape of the tube from springing in) and the turret moved forward for the boring bar *O* with blade *N* to rough bore the hole in the tube. While the hole is being bored, the turning tools *Q* and *R* turn the outside diameters *K* and *L* simultaneously. The front cross-slide form blocks with blade *D* is also moved forward and the outside taper *C* is rough formed.

Referring to the letters on the former blocks, *D* represents the cutter, *E* grooves, *F* binder screws, *G* binder bolt, *H* adjusting screws, *I* cross-slide block clamp screws, *J* former block. When the first face of the turret and front cross-slide block have rough turned the outside diameter, the turret and block are withdrawn from work, and the turret revolved to the next face, which holds a boring bar. The boring bar *T* with cutter *V* and adjusting screw *U* then finish bore the hole. The turning tools *Q* and *R* finish turn the outside diameters *K* and *L*. At the same time the rear cross-slide block finishes the outside taper *C*. The cross slide and turret are again withdrawn and the turret revolved to the next face, which holds a floating reamer.

The hole is then reamed. After the hole is reamed the turret is revolved to the next face which carries the tap. The tap shank *Z'* slides into the tap holder *Z* and when the hole *M* is tapped the turret is withdrawn quickly, leaving the tap in the tube to be withdrawn by hand.

The turret is held very rigidly, and pilot bars steady the tools.

The machining of the tube for the first operation is as follows: The tube *C* is gripped by the jaws *A*. The drill is then put through the tube and at the same time the turning tool *K* roughs the top of tube *F* before the rear cross-slide tool *E* commences to operate. This being done the drill is withdrawn and the turret revolved to the next face, which holds the rough former *M*.

This tool with notched cutting edges, roughs out the inside of the tube *D* and at the same time the front cross-slide tools *G* and *H* finish the two sides of the tube. This done, the turret is withdrawn and revolved to the next face, which holds the finishing former with two inserted blades held in place with the four screws *U*. This tool just scrapes the inside of the tube to make it run true and leaves a very smooth finish. The turret is again withdrawn automatically and the first operation is finished.

Second Operation

Fig. 3 shows the tube held in the reverse way. To insure accuracy and perfect alinement it is advisable to grip the tube on *A* with a collet. A collet will grip the outside diameter *A* all around and insures a good grip for driving.

Fig. 4 is the front cross-slide former. Fig. 5 is the rear cross-slide former.

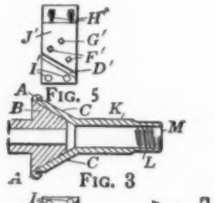


Fig. 3

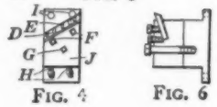


Fig. 4

Fig. 6

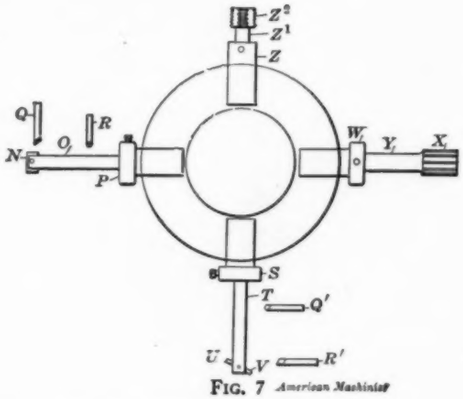


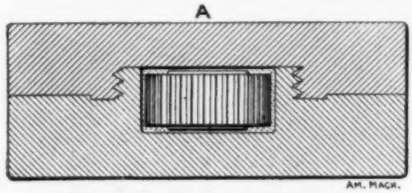
Fig. 7 American Machinist

Second Operation on the Tube

A Kink for Hardening "Novo" Steel

By J. H. Harris

A method of hardening tools of "Novo" steel, especially screw-machine circular tools, without in anyway injuring the cutting edge or discoloring the surface of the tool is shown herewith.



Box for Holding Cutter

A is a steel or wrought-iron box with a space that will just contain the circular tool. The box is made in two pieces, one being screwed to the other. The cutter is placed in the box and finely powdered fire clay or charcoal is used to fill around the space left between the cutter and the box. The top is screwed down tight and the box and cutter brought to proper hardening heat and then quenched in water. The quenching in water is not injurious to the cutter, as the water does not come in contact with it.

This method of hardening leaves the cutter just as smooth and bright as when it was placed in the box, thus avoiding the necessity of polishing.

The late Sir William Siemens used to say that he dreaded an interview with an inventor, for he knew he should lose valuable time and make an enemy for life.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Lubricating Device

Though there is no feature more essential to the life of any machine than good lubrication, the designer generally thinks he has done his full duty, in the case of ordinary journals, when he has put in tapped holes and called for grease or oil cups of approved design.

As far as the drawings are concerned he has disposed of the problem in the quickest and cheapest way and he has followed a practice sanctioned by long usage, so that he can claim immunity from criticism, which is an important consideration in his mind.

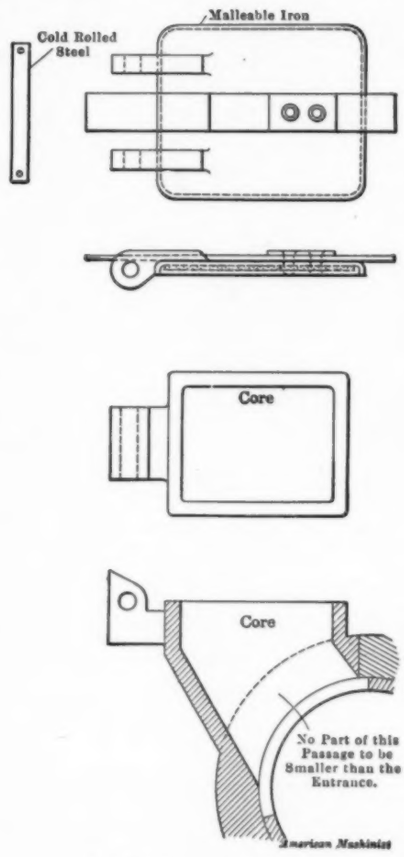
But I propose to show that, all things considered, he has chosen neither the best nor the cheapest device and certainly not the one that will prove most satisfactory to the purchaser and operator.

Grease or oil cups, referred to hereafter simply as cups, are easily broken off, lost or stolen, especially stolen, if of brass and used on an out of doors machine in the neighborhood of a large city.

The small grease or oil holes sometimes get plugged so that the lubricant will not run into the journal, particularly in machines working in dusty locations. It is not uncommon, in the case of compression grease cups, or other forms with screw tops, to find the top stuck and instead of it unscrewing, the shank unscrews out of its tapped hole. The liability of this happening is greatly increased in machinery having much vibration and this often results in damage to the threads, requiring retapping.

Failure of oil to flow on cold mornings has been an occasional cause of heating and cutting of bearings with cup lubricators and these also often feed too much or not enough. Too much lubricant is a needless waste and a cause of expense; and not enough causes loss of power in overcoming excess of friction and an increase in the machine repair bill, not only for worn bearings but in the driving parts, such as belts, chains, sprockets, gears, motors, etc., because of the increase in the power they have to transmit. For instance 10 per cent. more friction would mean 10 per cent. more belt pull, which would react to increase the friction, etc.

But, the greatest objection to cups on most heavy machinery is the amount of time and attention needed to keep them filled and working properly. Count the number to be attended to on some ordinary machines and you will find that twenty, thirty and often forty have to be filled and adjusted each morning before starting work and many a half hour is lost in that way.



A Lubricating Device

I know that small oil wells with covers of various kinds, ranging from hinged, with or without springs, to plain, loose covers; some designed to be packed with waste in contact with the shaft, others with small oil holes leading to it, are used to quite an extent but none of these are as efficient, though all are nearly as costly as the type shown in the illustration.

This type is distinguished from those just mentioned by having a relatively large opening for refilling or inspection and by having a large opening leading to the shaft, on its no-pressure side preferably, and by having a spring-hinged cover which snaps shut when raised to any less than full opening hight. It is felt lined so as to be dust proof. But the main feature is the wiping of a large percentage of the length and circumference of the shaft bearing by oil-soaked waste which spreads a thin film of oil on it.

I make no claim to originality of design. It is the standard railway type of journal box as modified by builders of railway motors to suit their purpose. I think that builders of other kinds of machinery will find its adoption advantageous wherever conditions warrant its use.

I have been using oil wells of substantially these dimensions for several years in different patterns, for both steel and iron castings, made by different foundries and have never heard any complaints of their being hard to make nor is there any perceptible difference in the price per pound of castings as compared to other castings of about the same weight. In order to have them both easier to draw and to make I have made some slight modifications in the design used hitherto; this rids the design of some small fractions of inches and puts the 13/32-inch hole in the hinge boss central in it and on a line with the top of the oil well.

Consider what it would mean to have to attend to the journals of a thirty- or forty-car freight train, if each were lubricated by grease or oil cups, compared to the results obtained with the present type of journal box.

Furthermore the car-axle journal is conceded to be the most efficiently lubricated journal in ordinary use, bar none, not even the ring-oiling or other high-grade type. Its entire length is wiped by oil-soaked waste which also coats it with a film of oil, practically none of which is wasted, and it is easy to inspect, clean or renew, while the percentage that give trouble is almost negligible, though exposed to clouds of gritty dust, freezing cold, rough usage and but scant and hurried attention at irregular intervals.

The dimensions of the hinge boss etc., being standard, as chosen by the Master

Car Builders, results in any make of cover fitting any other make of journal box, though the details of construction or the materials used vary widely in different makes.

STANDARD TYPE OF LUBRICATING WELL WITH INTERCHANGEABLE COVERS

The purpose of this paper is not merely to urge the adoption of this form of waste-packed oil well and cover, by machinery builders in general, but to urge that, in adopting them some standard be adhered to. In offering the accompanying design I have no ax to grind and if any other dimensions will be more popular I am ready to adopt them. There is no more reason in slight variations from a standard than there would be in varying slightly the taps for cups, and the advantages of a standard needs no pointing out to readers of the AMERICAN MACHINIST.

To have a standard, all that is needed is to retain the dimensions of the *hinge* boss and of the outside of the top of the oil well. Vary the inside dimensions to get thicker or thinner walls or vary the shape of the outside below the top as much as you please, and change the cover to be thicker or thinner, with or without felt, with stronger or weaker spring, attached any way you please, and we will still retain the standard that will make covers interchangeable.

A machine with this type of oil well and cover has a strong talking point that appeals to the practical machinery purchaser. It saves in oil, repairs and labor and its convenience will cause the machine runner to give a favorable opinion of it which is liable to count a good deal with some prospective purchaser. I think that I am now safe in assuming that I have proved all that I set out to prove except that it is cheaper in first cost. To do that I will consider the cost of the 13/32-inch hole in the hinge boss as at least offset by the cost of drilling and tapping a hole for an ordinary cup. Taking the cost of the spring cover at 35 cents and of a steel cup at 15 cents, we have 20 cents to be saved elsewhere.

Now *core* out (not cut out afterward) in the first place, the outlet in the bushing or lining, whether bronze or babbitt, and value either metal at but thirty cents per pound finished or in place, and the saving will not only wipe out the 20-cent deposit but will leave a balance that will cover the extra metal in the journal casting, if any is added, and also pay for the slight extra cost of drawings and patterns.

To anyone who is not convinced of the correctness of my arguments I would recommend an actual test of enough bearings to form a fair basis for judgment.

The cost will be slight and much may be gained.

Scottdale, Penn. F. D. BUFFUM.

Alterations to Patterns

Many times, in the experience of a patternmaker, after having a few castings made it is found necessary or advisable to make a new pattern instead of altering the one in use. Such alterations may take the form of "stopping off" certain parts or changing a right- into a left-hand casting. Whichever it may be, it is presumed that the time necessary to make the alterations is not sufficient to warrant the making of a new pattern.

It is very seldom that any objection is made to this kind of alteration, but to alter a pattern or core box at the request of the molder is not always palatable to the patternmaker, especially if the pattern has been made after consultation with him.

Most of us are liable to make mistakes and consequently where the suggested alteration is obviously an improvement there should be no hesitancy in having the thing altered.

It is, however, in the former case where

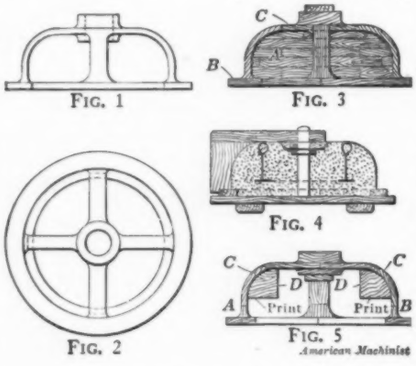


FIG. 1 FIG. 3 FIG. 4 FIG. 2 FIG. 5

ALTERATIONS TO PATTERNS

the supposed or real grievance comes in, for probably the patternmaker had already advocated the new way of doing the job but the molder, looking at it from a different standpoint, thought it would be better made the first way, then when he sees the job put together realizes his error and would like to have it altered. The only satisfaction the patternmaker then has is in the retort "I told you so," but such satisfaction does not pay dividends.

Another sore point is where the patternmaker has made the pattern after duly taking everything he knows into consideration, and we must give him credit for knowing a little about molding, and has made a good job of it, and may even have gone to a little extra trouble on certain parts to help the molding, he finds that he has committed one serious mistake, viz.; failed to consult the molder, and for this reason the latter thinks he has been slighted and consequently has the pattern altered in some way, even if it is to his disadvantage. Happily there are not many of this class in authority. However, there are many occasions when it is advisable to have patterns and core boxes altered. Instances arise where the alteration becomes necessary through a kind of evolutionary process. The pattern may have been made in the first instance in a tentative sort of way and the molding done under ordinary conditions, but, through a considerable increase in the number of castings required, it is found advisable to make special arrangements for molding which can only be carried out by having the pattern altered to suit. Occasionally it may even be profitable to make a new pattern throughout. Such a case was to be found in the making of a crown end bearing for a 10-horsepower motor as shown in Figs. 1 and 2. In the first place the order was for one casting only and it was not anticipated that more than two or three others would be required, but events turned out otherwise. The pattern was made with the idea of incurring the least possible expense, and in the following manner. A core print was built up to the form of the inside of the casting with the flange *B* fixed on to it, as shown in Fig. 3; on the top of this print *A*, is fitted the necessary webs joining the flange *B* to the boss *C*. The core for taking out the inside is then made by means of a pin board. This method being shown in Fig. 4; the center core for the shaft is made from a standard core-box.

As already stated, owing to the success of the machine, more castings were required, and it was necessary to make them cheaply. To do this we had to do away with the main core, and to alter the construction of the pattern so that it would not need one. The way this was done is shown in Fig. 5. It will be noticed that the pattern is made in two parts and jointed through *A B* for convenience of molding. Again referring to Fig. 5, it will be seen that if a wood pattern is to be used the parts marked *C C* will be very weak. These can be strengthened by fitting knee pieces inside as shown at *D D*, and they can then be used as prints and filled up with either green or dry-sand cores after the pattern is withdrawn from the sand. The cost of making these cores is small. Of course, if it is deemed advisable to have a metal pattern the knee pieces can be dispensed with.

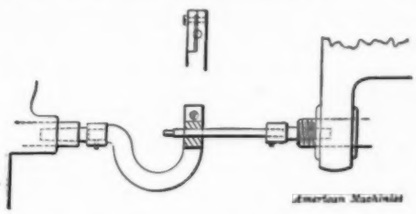
Lancashire, England. W. POTTER.

Turning Small Shafts in a Big Lathe without Steady Rest

I had a number of small shafts to turn up on the ends; they were 3-16-inch in diameter and ten inches long of selected cold-rolled round steel and were to be turned down on the ends to 1-16-inch in diameter and 3/16 inch from the ends. Now, to center each one on each end true with the outside, would take considerable time, and to use the common steady rest

would necessitate making the ends of the steady-rest jaws sharper in order to get them on the work. There were two taper collets for the lathe as shown, so I made bushings for the holes to reduce the diameter to the required size.

Then I took a piece of round steel and bent it to the shape shown, then by



DEVICE FOR TURNING SMALL SHAFTS IN A BIG LATHE

holding it in the lathe head and boring the hole in the bent end I brought the hole in line with the shank. I then sawed a piece out, as shown, forming a cap and fastened with a screw to take up the play if the stock varied any, but sawed the piece so that half of the hole would be in the supporter for a better bearing. By boring it in the lathe, as mentioned, when put in the tailstock the hole was in line with the spindle. This support leaves plenty of room for the tool and enabled me to do a very quick and satisfactory job.

Philadelphia, Penn. FRED HENKE.

An Electric Drive for an Old Planer

The halftone shows the way in which a large planer, capable of taking work twelve feet high, was equipped with an electric-motor drive, where it had formerly been driven by a line shaft across the roof. Its cutting speeds were slow, but this was not a matter of importance, because the work for which the planer was used was very heavy, and consequently high speed was impracticable.

The table of the planer was twenty-four feet long and weighed 33,000 pounds. The average cutting speed was twenty feet per minute, with thirty feet per minute on the return.

The motor used was a thirty-horsepower interpole motor running 600 to 1200 revolutions per minute and with a normal capacity of 115 amperes at 220 volts. The above-mentioned cutting speeds were obtained at about the middle of the range of speed of the motor.

With moderately heavy work and from 5 to 6 leet length of cut, the working stroke at 20 feet per minute required 30 amperes. The return stroke at 30 feet per minute required 90 amperes.

When planing an engine bed weighing 135,000 pounds, with from 3 to 4 feet length of cut, the working stroke at 14 feet per minute required 50 to 60 amperes for the heaviest roughing cuts. The return stroke at 21 feet per minute started with a momentary rush of 80 amperes, dropping to 70 amperes during the return. Fnishing cuts at the same stroke and speed took from 45 to 50 amperes.

With the same bed plate, but with longer strokes, the amperes for cutting were about the same, but on the return stroke the current dropped down to 60 amperes.

It will thus be seen that the motor was sufficiently large for the work, especially when a heavy piece was being machined, for the shock allowable on the reverse kept the speed down to a point much below the capacity of the motor. For this very heavy work the performance of the tool would have been better if the cutting and reverse had been at the same speed, as the limit of speed was what the machine could stand on the reverse, and the cutting stroke might as well have been at the same speed.

As is shown by the illustration, the motor was fastened to the top of one of the columns of the planer, while a countershaft was fastened to the top of the other column. The belt was put directly above the cross bracing, so as not to interfere with the handling of work by the cranes. An iron ladder gave access to the motor from the floor, and a board across the planer beside the belt made it easy to inspect and oil the whole apparatus.

This drive has been in operation for four years without giving any trouble or requiring any particular attention.

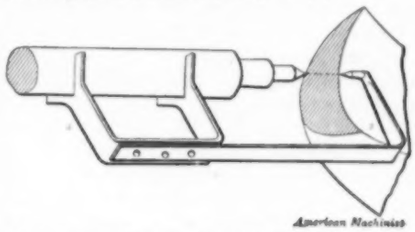
The cost of changing this planer to the electric drive was $1010.43.

EDWARD T. CHILD.

Philadelphia, Penn.

Transferring Holes on the Radial Driller

The illustration shows my way of transferring holes from the inside to the outside of arms that were part of a casting about 6 feet in diameter.

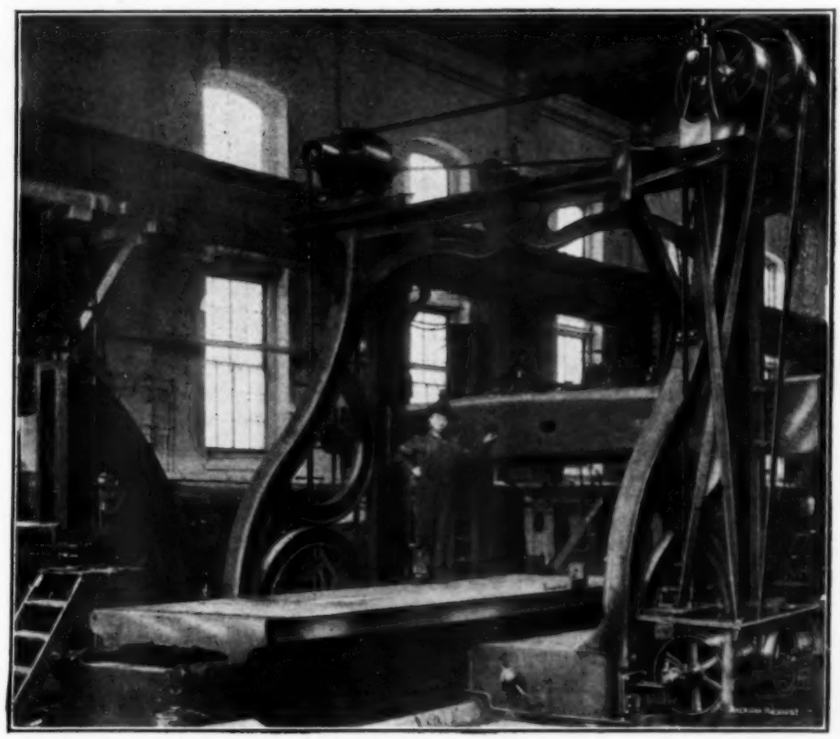


DEVICE FOR TRANSFERRING HOLES ON THE RADIAL DRILL

The outlines of those arms were all curves and were parallel. A little plain blacksmithing applied to two pieces of flat iron, and three rivets, made the tool illustrated, which I think almost explains itself.

The casting is put in the right position for the hole to be drilled. The tool is held, by hand, against the drill spindle and the spindle moved until the pointer meets the center of the laid-out hole on the inside.

The drill spindle holds a sharp-pointed lathe center and a slight bump produces the prickpunch mark, for the desired hole



ELECTRIC DRIVE FOR AN OLD PLANER

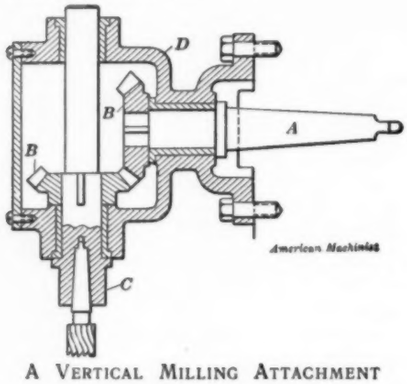
center, on the outside. Then the hole is laid out and the drill takes the place of the lathe center. This tool requires no accuracy, except that the pointer has to be bent to meet the point of the lathe center.

High Bridge, N. J. J. SCHWING.

A Vertical Milling Attachment

We had a large amount of work to do that required a vertical miller and as the firm was not willing to buy an attachment, we made one.

Its construction is shown by the illustration and is as follows:



A VERTICAL MILLING ATTACHMENT

The main casting *D* is made to bolt to frame of the machine.

Taper spindle *A* is made to fit the socket in the machine and the vertical spindle *C* is driven from *A* by a pair of bevel gears *B B*.

This attachment has been in use for several months and has given good service.

One advantage that it possesses is that it can be applied to any machine, having a taper socket of standard size by drilling and tapping three holes and using cap screws to retain it in position.

Philadelphia, Penn. W. ALTON.

Attachment for Test Indicator

Some time since I purchased a test indicator and by adding the attachments shown in the accompanying illustrations I have greatly increased its efficiency.

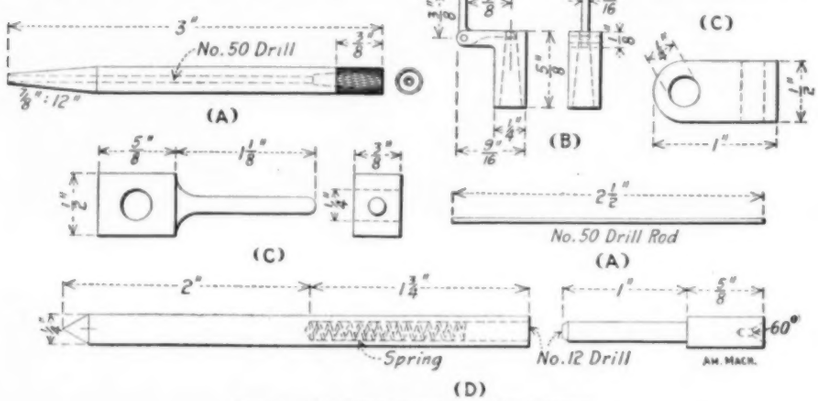


FIG. 1. ATTACHMENTS FOR INDICATOR

It can be used to true up a prick-punch mark on a die or tool, by placing the point of arbor *D* into the prick mark and the other end on the tail center. Next place the contact point of the indicator against the arbor as near the work as possible and you can tell just how much to move the piece. The spring in the end keeps an even tension between work and center. Next, take the long finger *A*, which fits on the plunger end of indicator and with piece *B* a hole can be trued up quite a distance from the face of work.

We next have piece *E* which has a No. 7 Brown & Sharpe taper shank, to be used in the miller or grinder. By fastening the indicator on this attachment as shown in the illustration, we can true up buttons on jig and fixture work on the miller.

To get the reading of the instrument when the graduation is out of range, use a small hand or pocket mirror, and I have trued buttons as close as 0.0003 inch with it. Attachment *C* is for using the indicator in connection with a surface gage, to transfer measurements from the hight gage to buttons and work of a similar character. C. BILLINGS.

New Britain, Conn.

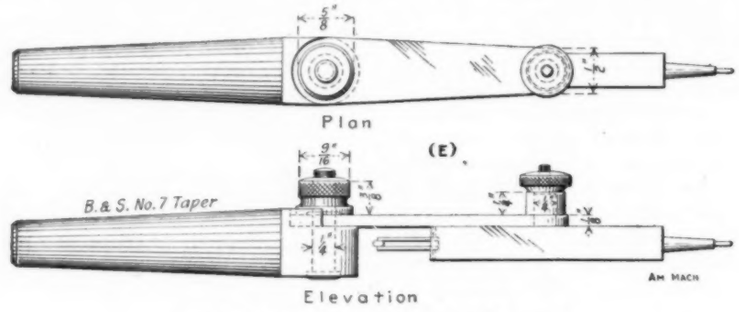


FIG. 2. THE ATTACHMENTS IN PLACE

Two Bending Tools for Small Parts

The illustration shows two bending tools similar in design, which are employed in making adjustments on several different parts of a well known adding machine. These adjustments can only be made when the machine is completely erected. At *A*, in Fig. 1, a 3/16-inch saw cut is milled at an angle, to accommodate the hardened tool-steel jaw *B*, which is free to swivel in this slot on the hardened 3/16-inch drill-rod pin *C*; this pin is neatly rounded on the end and a light drive fit in *A*. The 60-degree center formed on the end of *D*, in contact with the radius part of *B*, operates the latter. *D* is made of carbon steel, hardened on the conical end only. The bender, Fig. 2, is practically on the same principle, although embodying two movable jaws *B*. The working parts of these jaws are made in angular shape, similar to the V's on a lathe, thereby increasing the leverage, and also preventing the mutilation of the part being adjusted. In the machining of Fig. 2, a ¼-inch saw cut is milled, at right angles with the center line, and finished with a ⅛-inch radius milling cutter; this shape reinforcing *A*, which is of minor importance. After *B* has been machined on the two opposite sides, it is advisable to drill and counterbore it to a size that will be a neat fit in the slot in *A*.

Detroit, Mich. DAVID MELVILLE.

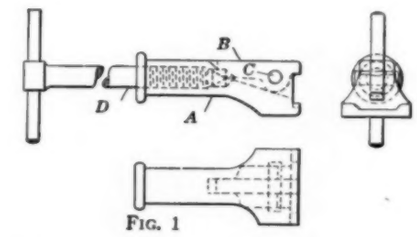


FIG. 1

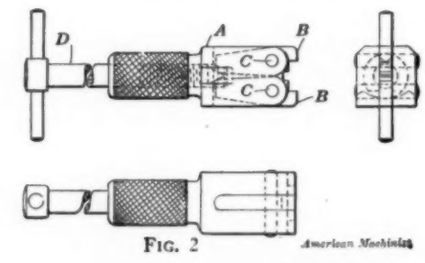


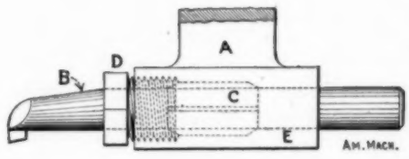
FIG. 2

TWO BENDING TOOLS

A Splining Tool

A is the holder drilled to fit the tool *B*, which is of ⅜-inch stock. *A* is also drilled for the split bushing *C* and tapped for the screw bushing *D*.

When the bushing *D* is screwed upon *C* (which is split and tapered on each end) it compresses and grips the tool *B* firmly, besides having a bearing at *D* and *E*.



A SPLINING TOOL

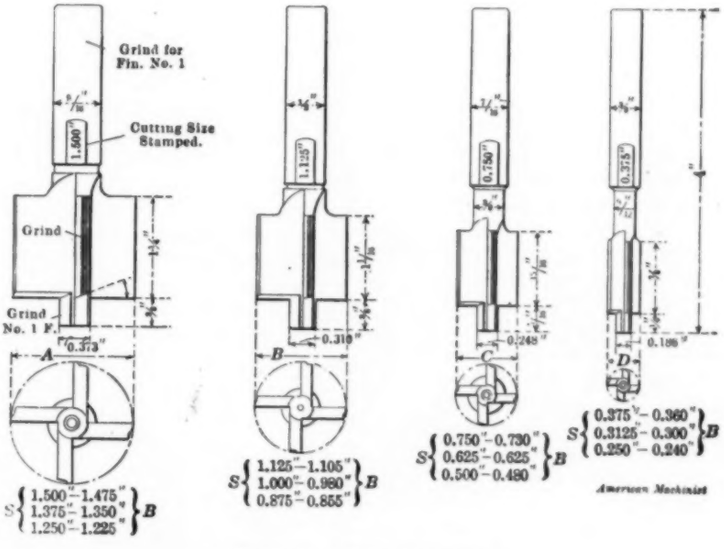
The chief advantages of this tool are these: You have a separate tool for each size slot, with only one holder, and they can be adjusted in or out according to the length of the hole; then there is the rigidness compared to the forged style which is the same length for every length of hole.

Boston, Mass. PEDRO.

Counterbores

The illustration shows the dimensions of counterbores, which we made successfully and economically for the use of our shop. As will be seen they range in size from below ¼ inch to 1½ inches diameter, 24 sizes being included.

The dimensions marked *S* require standard sizes, while those marked *B* are for sizes which will cut holes that will allow for finish of bar stock used to make bushings for the holes. For example, if bushings are to be made from 1-inch bar stock the counterbore marked 0.980 inch would be used.



STANDARD COUNTERBORES

For first-class work, the shank, pilot and outside are ground, while if less accuracy is permissible it will be necessary only to grind the blades. The narrow, relieved lands prevent excessive friction which is caused by cast-iron dust and fine chips.

The straight flutes, especially for the larger sizes, may be objected to by some, but when run at proper speeds and well lubricated, for hard materials, they were found to work very well, and are, of course, much easier to make than spiral flutes.

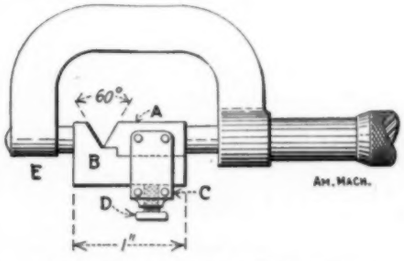
It is rather difficult to sharpen these counterbores, as is the case with all that have solid pilots.

The lengths are the same for all sizes for the sake of uniformity. They may seem rather short, but are made so to save material. The pilot hole should always be reamed for good work.

Buffalo, N. Y. ARTHUR F. KUNZE.

Adjustable Thread Tool Gage

The illustration shows the workings, "in connection with a micrometer" of an adjustable-thread tool gage for the tool-



ADJUSTABLE THREAD TOOL GAGE

maker. *a* is a piece of tool steel about ⅛ inch thick, which is hardened after bringing to the shape shown in the sketch; *b* is also made of tool steel hardened; *c* shows the sliding arrangement and *d* the locking screw. Great care should be exercised in grinding *a* and *b*, especially the angles for tool to be ground by. The shoulder on *a*, shown at *e*, serves to stop the sharp edge of the angle on *a* from striking the bottom of the angle on *b*.

Now let us suppose that the tool, over all, is ground to, say one inch, and the tool is set for a sharp or V thread, and we want to get the flat for an eight-thread tap; then since the

$$Pitch = \frac{1}{N} \text{ and } F = \tfrac{1}{8} \times P$$

it will be seen that by moving part *a* of tool backward 0.0156 inch we will have the proper flat for our tool to be ground to. This same idea may be used for the 29-degree thread by simply grinding the tool to 29 degrees instead of 60 degrees and using the following formula:

$$P = \frac{1}{N},$$

$$F = 0.3707 \times P,$$

$$F_1 = 0.3707 \times P - 0.0052,$$

in which

P = Pitch of thread,

F = Flat at top of thread,

F_1 = Flat at bottom of thread.

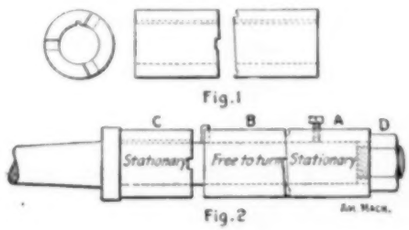
Carbondale, Penn. M. CLARK.

Spacing Collars for Millers

One of the most common jobs done on a miller is to set up two side milling cutters on an arbor and "straddle mill" the work to size. This is an excellent method to employ when a number of pieces must be machined to exactly the same length or width.

The difficulty with the straddle gang is to set the cutters to mill to size after they have been ground, and maintain it for a great number of pieces, for the cutters are bound to wear and leave the work large.

The common way of setting these straddle gangs is to pack paper washers between the arbor collars until the proper



SPACING COLLARS FOR MILLERS

size is reached. All who have used paper washers in this way know that in nine cases out of ten the cutters will cock as soon as the arbor nut is tightened, thereby making one side of the cutter do all of the work besides producing a very poor finish.

The accompanying illustrations show some adjustable arbor collars which we

have used with very satisfactory results. Fig. 1 shows an adjustable pair of collars the way they are mounted on the arbor as well as an end view of one of the collars. The pair consists simply of two ordinary arbor collars with three clearance notches milled in the end, and the intervening segments tapered down equally.

Fig. 2 shows a method of making duplicate pairs of collars. *A* and *B* are a pair which have already been made *B* having a small cutter fastened in one end, this cutter being set at right angles to the arbor. *C* is the collar to be tapered off, it having already had the three clearance notches milled in the end. By fastening a lathe dog on collar *B* so that it can be turned by hand and feeding down by tightening the arbor nut *D*, *C* can be tapered off exactly like *A* and *B*. After a pair of collars have been tapered off in this manner they are put together on a mandrel and the ends faced off in a lathe. This will insure the proper alinement of the cutters when in use.

Collars made in this way are much cheaper than the screw and nut type which I have seen used, and, for small adjustments serve the purpose just as well, if not better, as there is no possible chance for them to cock over on one side and spoil the alinement of the cutters. It is a very easy matter for the operator to loosen the arbor nut and give one of the collars a slight turn in order to get the required size.

Cincinnati, Ohio. R. W. G.

Refitting a Loose Pulley

Next to the friction clutch I think the *loose* pulley is the greatest source of annoyance to the shop superintendent who has any regard for the comfort and safety of his men. Both of these as ordinarily constructed are a constant menace to the safety of the workman who operates the machine so driven, as they are continually sticking, causing the machine to start up most unexpectedly and very often pinching the operators' fingers if not injuring him more seriously.

If the superintendent were to express his feelings at the time one of these pulleys was *joyfully* spinning on its way and at the same time treating everybody within a radius of about a mile to the most horrible, nerve-racking noise, I think "abominable" would be just a little too mild a word for him to apply to this particular piece of mechanism. Of course being a wise one—for he could not have attained his present position if he had not learned a few things—he does not express his feelings but only thinks them.

The scheme was bad enough when the pulley was provided with an oil cup or even a plug to close the oil hole, but of all the *imbeciles* the one who puts a hole in the pulley hub and thereby provides a more ready means of escape for those few little drops of oil that possibly did get in—well! to put it mildly "he is the limit."

There is a certain amount of satisfaction in overcoming a stubborn and annoying problem and for the benefit of some other fellow sufferer I am sending the following description of a cheap and satisfactory method by which we solved this most vexatious problem.

Usually when we find the pulley worn large in the bore we also find that the shaft is worn about 1/16 inch smaller in diameter where the pulley has been running and, if unable to turn the shaft end for end in its bearings, it means a new shaft and bushing the pulley. With the method I am about to describe we do not replace with a new shaft but use the old one, which very often means a considerable saving of labor and material, for the last machine we repaired in this manner was a blower, which had a *turned* shaft forced tightly into the drum and which was perfect except where the

Fig. 1

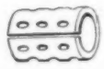


Fig. 2

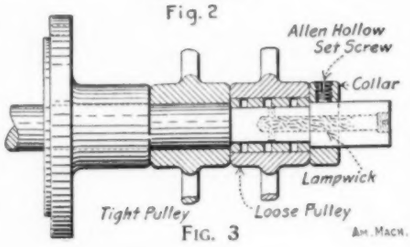


FIG. 3

REFITTING A LOOSE PULLEY

loose pulley had run on it. The manner in which we repaired it was this—we first swung the drum and shaft in the lathe and turned the worn portion down just enough to true it up again as shown in Fig. 1 and while still in the lathe we drilled a ½-inch hole in the end of the shaft as deep as shown in the sketch. After drilling a small cross hole as shown at *a*, Fig 1, and thoroughly cleaning out hole and half-filling same with lamp wick, as also shown in sketch, a narrow bushing with about a 3/16-inch hole in it was forced into end of shaft. The shaft was now ready for the bushing, which is shown in Fig. 2. It is made of cast iron, turned on the outside for a running fit in the re-bored pulley hub and also bored for a running fit on the turned portion of the shaft, it was next slotted with a hack saw on one side, only, as shown, and a number of small holes were drilled in it to hold the oil; care being taken not to drill any *opposite* the slot as it must spring open far enough to allow it to be forced over the end of the shaft and into the relieved portion of same without breaking.

The whole arrangement assembled is shown at Fig. 3, and it can readily be seen what an easy matter it is to keep it well oiled. The idea of the split bushing was suggested by George Cooper and the oiling method is my own. We have applied this scheme to a number of machines and it is working very satisfactorily—so much so that we think we have solved this most vexatious problem.

E. A. ERMOLD.

Philadelphia, Penn.

The Electric Furnace for Steel Castings and General Foundry Work

At the present time some of the Heroult furnaces are busy on steel castings, in fact some are exclusively erected for that purpose; for instance, at the Fischer Steel Foundry, Schaffhausen, Switzerland; Lake & Elliot, Baintree, England, and out of 40 others in operation most of them are intermittently employed for castings, as for instance, at Worcester and South Chicago. The steel is perfectly sound, of high quality and was good and hot when cast. It is so dead when poured that it is not necessary to increase the percentage of silicon which is 0.15 and lower.

A more interesting feature of the electric furnace is that it seems to be capable of improving the quality of foundry iron at very low cost and by a very simple operation.

The main feature of what is called strong iron is the low content of sulphur. The removal of sulphur is one of the easiest and most effective operations that can be performed in the electric furnace. It consists simply in pouring into the furnace a charge of molten pig iron, if possible direct from the blast furnace, if not, from a cupola or other melting apparatus, then heating the metal under a basic slag which does not have to be scraped or removed except when it is teemed into a ladle with the metal ready for pouring. The contents in carbon, silicon, manganese and phosphorus are not affected by this operation unless this be desired. Common bessemer iron worth anywhere from $10 to $14 per ton can be changed into strong iron, charcoal iron, carwheel iron, or so called cold-blast charcoal iron for a cost of about $1 per ton.

It seems probable that on account of the high grade of material so cheaply produced, a large proportion of the iron castings of the future will be made of this improved quality. This new improved product may help to give new life to the iron-founding industry.—*Proceedings American Foundrymen's Association.*

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Industrial Education

The article on "Industrial Education," by Lewis H. Haight, at page 460, contains so many statements that are open to criticism that at first glance it would seem best to ignore it. On the other hand, it has been my experience that unless such statements are immediately answered, someone will arise and say that we did not dare to answer them.

Mr. Haight's contentions, stripped of the illustrative details, are:

1. All schools for industrial education should be called "Preparatory Trade Institutes."
2. It is impossible to teach a trade in school.
3. A trade school should be equipped with second-hand machinery.
4. It would drive instructors crazy to attempt to produce a marketable product with inexperienced boys on uptodate machines.
5. Trade-school teachers should have normal school or college training.
6. Boys should be given a two years' workout in all departments. (Limited in New Bedford to two trades, wood work and machine work).
7. A boy should be inducted into the shop by being ordered to loaf around and pick up what he can from other boys.
8. Trade-school activities may well be confined to repair of second-hand machinery.

Inasmuch as most of these points are being looked at in a different light in Worcester, I wish to ask the reader's attention to a brief discussion of each.

Name of the Schools

If these schools are trade schools, why not say "Trade." We put it over our door and we doubt if it has driven a single boy away that wanted to become a mechanic.

If it is not the purpose of the school to teach a trade, then it ought not to call itself a trade school. If New Bedford wants to have a "Preparatory Trade Institute," then that is a very proper name for it; but we do not, and we know of a number of other schools that do not wish to be brought under that category. On the well tried principle that what is worth doing at all is worth doing well, we believe that the public is entitled to see its money spent in a good, thorough attempt to teach a trade. We find that there is one ground on which labormen and manufacturers can agree, and that is that they do not want our shops flooded with a lot of half-baked mechanics, who must be assimilated and digested before they are fitted to their places in the productive world.

Do not by this understand that we think that we can turn out boys who will go into any shop and take any man's place at a moment's notice. We believe that we can turn out young men who can go into any shop and take their places alongside men who have served an apprenticeship in a dissimilar shop. For example; if we send a boy to the loom shop, we expect he will make good as well as a boy who has served his time in a tool shop under the same circumstances. Also if we send our boy to a tool shop, we expect that he will do as well as any man who might have gone there direct from an apprenticeship at the loom works.

Impossibility of Teaching a Trade in a School

A man may also say that it is impossible to teach a trade in a shop or in any number of shops. It is true that a live man will be gaining in knowledge and ability until after he has begun to go down the grade of physical strength. I believe that it is possible to teach a trade better in a school than has been done in the past in any shop not having a special course for apprentices. This is based on an experience quite as long and quite as varied as Mr. Haight's. Though I like to think of myself as a young man yet, I can "point with pride" to machinists and foremen in almost every shop in Worcester who got their start under me, and I believe that I am competent to judge of the requirements at least of local shops.

Given a school shop, in a building of mill construction, or one even more modern, with the best equipment that money can buy, with an abundance of work of all grades, and instructors who know their trade, who are interested and enthusiastic and who are paid something over $900 per year to train the boys to get out salable product—and that must pass the inspection of outsiders—why should not the boy advance more rapidly than in a shop where the boss regards him as a necessary evil? The only possible way in which this argument can break down is in the event of pupils not staying through the course. Even this, while it may affect the result, does not affect the argument, for if the boys leave the course it will be only because some short-sighted manufacturer cannot wait for the fruit to ripen before he picks it. I have faith enough in our local manufacturers to believe that if their attention is properly drawn to the matter that they will coöperate with us.

Second-hand Machinery

I regard it as an imposition to set a boy at work on a machine that it would puzzle an experienced man to make do good work. If there is any time when a boy needs to be made to work accurately, it is the first day he is in the shop. He needs the best machinery there is. Not the machine with the most gear feeds, speeds, automatic stops, etc., but the best built machinery, kept up to the mark. We believe in using second-hand machinery, but not until it has been rebuilt, not just patched up to run. The Massachusetts law places a temptation in the way of various city officials in this direction, for these schools are entitled to one-half their cost of maintenance from the State, but cannot draw any of the cost of equipment. Therefore, there is the temptation to install second-hand machinery just as it is bought and then to gradually patch it up, charging the repairs to maintenance and getting so much more State aid. This is unfortunate, since the rebuilding of second-hand machinery, in distinction from repairing it, is one of the best things that boys in the second or third years of this course can do.

Referring to item 4, so far as I have been able to observe, none of our instructors are in any different state of sanity now than they were before they came here. To be sure we have found some of them lacking in some of the things which we regarded as essential in an instructor, and we have had to part with them, but that is not to their discredit at all, any more than it shows that the ink that I am using is of poor quality, because my wife refuses to use it for milk.

Given the work necessary in sufficient quantity and of proper simplicity, the first few months of a boy's course in the machine shop is the easiest part to handle. He simply has to be stood up in front of the lathe or a shaper or a miller and taught to "operate" it on repe-

tition work. Later in the course, when he must learn to set up his machine and lay out his work and get out his own tools, a lot of real work must be put into him, but the question of using new machines and new boys is very nearly parallel to the question of putting new wine into new bottles. In the year and more that we have been operating in Worcester, using machinery that had never been turned over before the boys took hold, the total cost of upkeep to machine tools caused by day pupils—we have a registration of over 140 now—has been but $23.36, mostly replacing of rocker gears in engine-lathe headstocks. The boys take a degree of pride in keeping this machinery in good condition that they never would with old traps.

Training of Teachers

In this one instance I would agree with Mr. Haight if I knew of men with 10 years' shop experience who would drop everything and go to the proper training school for two years, and if I knew of the proper training school. I do not know of any such school or college where there is the necessary opportunity to practice teaching along shop lines, nor where there is a master of the art of teaching shop work.

Let us try to classify the requirements of a good shop instructor as follows:

a He must be of good character.

b He must have a personality that attracts boys.

c He must be sufficiently firm to maintain absolute control over the boys.

d He must have a wide range of experience and had best be a specialist in some line.

e He must be able to tell what he knows in simple, direct language.

f He must have a well balanced idea of the value of time and what constitutes training for a trade, so that while he will keep boys busy, he will keep them progressing toward the goal of a skilled mechanic.

Given all these qualities, I do not believe but that a very small amount of training in the small amount of pedagogy involved in the work will suffice. As for psychology, it is my experience that the better grade of machinist about here is pretty good in that line without knowing it.

Of the above, *d* is desirable in order that the instructor should be able to give the boy the best of modern practice along some one line and yet recognize the desirability of an all-around training; *e* is most necessary of all and most difficult to get, because the really valuable man has gotten his experience under conditions where output has about been his idol. To put him into a school where the essential thing is the input (into the boy) is so radical a change that it takes time for him to get the point of view, and I am sorry to say that some never get it.

On the other hand a technical graduate, no matter how good his shop experience may be, has another adjustment to make in adapting himself to trade-school work, in that he is apt to apply the methods by which he was educated without change, while as a matter of fact the problem is so different that methods must be changed.

Variety of Trades

If a boy is to spend only eight hours a day, half the working days of a 40-week year for four years, it gives him 3200 hours, or only a trifle over one shop year of actual practice. We do quite a little better than this in Worcester, because we give the boy more hours per week and more weeks per year, making nearly twice as much, but the above amount is usual practice. With so little time as this, it seems as if it were necessary for a boy to make his choice and get down to brass tacks as soon as possible. So far as the boy's free choice is concerned, we feel that it is more likely to be influenced by what the older boys say of various instructors than by any question of his fitness for any trade. His father's choice on the average seems to be based mainly on having the boy do something different from what he does himself. Under these circumstances a boy is apt to make a poor choice; but his choice is no better if he has a chance to play at various trades. For then he is most apt to pick the one that appears to be the easiest to follow, regardless of the future that it holds out or his own fitness.

How to Start the Boy in the Shop

We consider that the first important thing for a boy to learn is that the shop is a place for work, pure and simple. We have no objection to the class-room work being made rather easy and want it made very interesting, so that the pupil may feel a degree of relaxation on going from the shop to class room, for the sake of making him feel the shop atmosphere all the more when he goes into the shop. We carry this to the extent that we cut out in every possible way all the instruction that is possible from the shop itself, both to lighten the burden of the shop instructors and to make the shop time as exclusively practice time as possible. To that end we have five special periods of two hours each, on alternate weeks, during which the boys have special instruction in shop processes, which is helping greatly to make their time in the shop more productive of good to them.

We believe, as I have stated above, that it is best to plunge a boy into the middle of things, both to show him that the work is interesting and to aid the instructor. It is a very much simpler thing to start a boy off on straight turning between centers or flat milling in the vise than it is to teach him to file a scrape or even to drill a circle.

Commercial Product

Why not face this question squarely? Making equipment or repairing old machinery, or making things for other city departments, all these things involve competition with established concerns. If we build a lathe for ourselves it means that someone else does not build it for us, and the employer does not make his profit nor the employee get his profit for making it.

On the other hand, if we make a lathe and dump it into the sea and buy another, there has been a waste of public money for material bought and for the new lathe. Taken all in all, considering carefully the rights of (*a*) wage earners affected, (*b*) employers affected, (*c*) boys affected, the line of justice and least immediate injury to all concerned seems to lie in the direction of making and selling whatever best meets the demands of the pupil for quality and quantity of work, selling it at the market rate to whoever wishes it, without exploiting the pupil. If to this it were possible under the law to add that boys should be allowed and encouraged to work extra time and be paid for their work, or be paid for production at over a given rate, then I believe that we would be close to the ideal. I do not believe that the total school output in any city or district can ever be of sufficient magnitude to have a real influence on either wages or profits. All the work that we did in the first year in Worcester would not have kept the machine shops in the city going more than half a day. When we have been running for four years, it is possible that our yearly output may equal half a week's output of all the Worcester shops, but even that is unlikely. Certainly it will not be so great as to interfere seriously with the business success of anyone.

We feel that the rebuilding of second-hand machinery is something that ought not to come at the beginning of a course, but only after the boys have acquired a degree of acquaintance with shop processes, so that they can intelligently handle the job.

Without going into detail as to the desirability of having schools to give boys an inkling of many trades, it seems to me that the important thing is to decide that trades *shall* be taught in trade schools. Then see that the schools do do it or throw up the job. As for manufacturers not wanting their graduates, it will be better to wait until there are some graduates and the employers have had time to find out what manner of men they are. So far as I know, there are no graduates of publicly supported "trade" schools. There may be some from schools that have half heartedly tried to

avoid the criticism of both wage earner and employer by doing nothing in a whole-souled way, but criticism based on these schools is not fair to those who have taken the bull by the horns.

E. H. FISH.

Worcester, Mass.

Hobbed Gears

There is just one point in K. P. Rolston's letter at page 694, Volume 33, Part 2, that calls for comment. He says, referring to my contention of curves instead of flats: "The theory will apply to worm gearing, as the hob tooth is constantly in the cut, and the revolving of the gear and hob will produce the curve," etc. It is just here that Mr. Rolston shows that he has not grasped an essential. It is this: A fly cutter to produce a curve must be traversed *across* the blank. As this does not happen in a worm wheel flats are there as certain as rent day, and they can be distinctly seen and felt on any worm wheel cut with a hob that is fed toward the axis. The reason for this is, of course, the non-continuity of the generating line.

In those machines that use a taper hob, or fly cutter, fed tangentially under the wheel, the hob teeth take up an infinite number of positions, and thus the flats are blended into a correct curve. How is it that no one ever complains about the "lean" or "skew" on teeth generated by this process?

In Volume 33, Part 1, page 1119, Mr. Grant admits that "under certain ill defined circumstances, the flats become rounded," and farther on he says, "I have not found it possible to obtain the highly rounded surface shown." . . .

The ill defined circumstances are Mr. Grant's own, as all I did was to take his fly-cutter example shown on page 1148 and after analyzing it to get the approximate relative movement, I plotted it with a slightly different angle. When the fly cutter is set central, say on a blank for 12 teeth, there will be little deviation from the straight, but set the same fly cutter to the right or left a distance slightly under one tooth pitch, this being approximately the position of the last working tooth on a hob when cutting a 12-toothed pinion, and it will be found that there is a considerable difference between the result and a straight edge. It could be proved mathematically that for the ordinary angle of 14½ degrees this sweeping action continues for a much longer period than is suggested in his article.

The point I wish to make is this—the sweeping action of the cutter is a maximum at the point on the gear tooth where the normals to the hob teeth are the farthest apart. These normals have been shown by several contributors, and if we ignore the sweeping action of each tooth we get a long flat at the top of a tooth in the 12-tooth pinion. Mr. Grant with his usual directness goes straight to the point when he says: "But the flat is not the major objection to the hobbed-tooth theory." No! the greatest objection is, there is too much theory in the hob with a consequence that there is too much noise from its product.

I was glad to note from John E. Sweet's delightful short article that he too had joined the anti-theory brigade, and would, if he made gears by hobbing "fake" his hob.

Apropos the "faking" of hobs, some four years back, in the department with which I am connected, a triple-geared headstock was designed specially for the high-speed drilling of holes from 3 to 5 inches in diameter through gun carriage axles. In the design ¾-inch pitch was used for the gears and as all our standard hobs are of diametral pitch it was decided that a ¾-inch pitch worm hob with *cycloidal* shaped teeth should be used. No special care was taken in the hobbing and, of course, from the shape of the hob teeth a bastard tooth form was the result. But this is the strange part; we have all sorts of gears running but none ran as quiet as these. On looking at these gears recently no abnormal wear can be observed in spite of the heavy duty they have been subjected to.

Based on this experience one fact stood out. If we get away from the straight sides we can materially strengthen our pinion teeth without interfering with the working form of them, other than the slight easing away of the tips which has over and over again been found necessary to smooth running.

THE LIMITING FACTOR

The editor in Volume 33, Part 2, page 1221, after commenting on the diversity of opinion on hobbed gears, says: "Would it not be wise to consider at this time the purpose of the hobbed gear and endeavor to establish its limitation?" It would! If I may venture an opinion, on this point, the limit to the hobbed gear at present, is the hob.

On page 1211 Harry H. Asbridge gives a suggestion as to how hobs with straight sides may be made that will correct the (tips)? of the teeth. This is not new except in its application, because, the method described is exactly what many firms do with their wormwheels under a certain number of teeth, with this difference that the gear is made larger while the hob is standard.

This method is mentioned in Mr. Grant's book on gearing (page 62) and was also referred to in a recent paper by S. H. Rowley read before the Manchester Society of Engineers. The great drawback to this method as applied to hobbing spur gears is that if it takes enough off the pinion it removes an abnormal amount from the larger gears.

No! this is not the solution although it is a step in the right direction, that is, toward a "faked hob."

WALTER G. GROOCOCK.

London, England.

Corrections for "Milling Cutters and Their Efficiency"

Upon referring to the printed report of my discussion of Mr. De Leeuw's paper on "Milling Cutters and their Efficiency," read at the Pittsburg meeting of the American Society of Mechanical Engineers, I note that the description is slightly mixed owing to the fact that the copy which I gave you had not been corrected in one or two particulars.

In Fig. 3, page 1135, the end view does not show one of the very essential features of this cutter, that is, the removing of alternate side teeth in addition to the beveling of the front face.

The words, "as shown in Fig. 3," referring to this cutter should be omitted; and where it is written, "someone suggested the cutter shown in Fig. 4," it should read "someone suggested the cutter shown in Fig. 3." In both cases, the cutters shown in Figs. 4 and 5 are face mills referring to an entirely different job.

The diameter of the small circle of this milling cutter to which the face of the blades are tangent, is ½ inch, and the included angle of the blade is 45 degrees, the same as Mr. De Leeuw's cutters.

In Fig. 4, the view shows the dovetailed key extending entirely across the hole. As a matter of fact, this key is in two parts, one-half on either side of the center hole for the arbor. As shown in Fig. 4, the arbor for centering the cutter could not be inserted.

A. F. MURRAY.

East Cambridge, Mass.

Strength of Flywheel Rims

On page 630, Volume 34, is given a useful formula for finding the stress in flywheel rims. It should be noted, however, that the density of metal is a factor in the formula. I mention this because cast steel is frequently used for large flywheels, and brass or gunmetal for those in small mechanisms.

Actually the formula reduces to this:

Stress (in pounds per square inch) = $0.001025\ D^2 N^2 w$;

where

D = Mean rim diameter in feet;

N = Revolutions per minute of wheel;

w = Weight per cubic inch of metal.

For cast iron

$w = 0.26$;

cast steel

$w = 0.283$.

I believe concrete flywheels also have been tried; for this, $w = 0.072$, about.

Manchester, England. FERNO.

Writing for Publications

On page 887, Volume 34, Mr. Plodman says, "to a busy man getting a good salary for his time, it is a money loss to put time into writing an ordinary magazine article."

I do not agree with this statement for I have had the pleasure of contributing to various technical publications for some years, and I have found in every case that if the article is of general value to their readers, and if properly written and accompanied by the necessary drawings, it is a decidedly good investment of time both from a financial view point and also on account of the mental benefit to me.

The ability which will enable one to be a regular contributor of technical information to a publication like the AMERICAN MACHINIST is in itself a strong recommendation and of material value to the possessor, and will be viewed with favor by any employer. Of course, the character of the articles, and the way they are presented are of vital importance.

Detroit, Mich. ARON LAWRENCE.

What Is a "Machine Tool" Builder?

After reading the editorial, "Is Machine Tool the Proper Term," on page 897, Volume 34, the question naturally arises, who has the best or prior right to the application of the compound noun "machine tool;" those who invent, design and produce machine tools, or those who would use the words merely as a figure of speech to describe some action or combination of flesh, blood and thought?

A milling cutter is not a machine tool, but is a milling tool; because it is an appliance which is applied to the accomplishment of milling operations, but subordinate to the more extensive and important miller. A miller is a machine tool because it is a combination of mechanism, or construction for utilizing and applying power to minor tools in the performance of actual work.

The "Standard Dictionary" and the U. S. Patent Office would say that, any combination of inanimate mechanism for utilizing or applying power to minor tools in performing actual work, is a machine tool; thus it would be logical and correct to say that, "a suitable frame or support, surmounted by a vertical spindle adapted to hold and drive a cutting or forming tool, and provided with means for utilizing and applying power thereto, in combination with work-holding means consisting of, etc.," is a machine tool; although it might apply to either a vertical driller, or miller, or a rotary riveter in the *metal-working* class; a mortiser, or a post driller in the *wood-working* class; or a profiler in the *marble-working* class; etc.

The machine-tool builders of any of the above classes should be equally interested in the columns of the AMERICAN MACHINIST, or in the advantages of membership in the Machine Tool Builders Association; and the inventor, designer and builder of a band saw for wood, may find it not only practicable, but profitable, to produce an equivalent for metal, provided, of course, he has had "machine-tool" experience, and not merely "metal-working machine" experience.

On page 895, Volume 34, Mr. Hildreth says that "machine tool" is a misnomer, and suggests "tool machine" as a substitute. Inasmuch as either term is but a general expression, they must be followed by the query, what kind? It may be desirable to drop the word too entirely when referring to a machine.

Why attempt to differentiate metal-working machinery from meat-cutting, bread-slicing, coffee-grinding, hay-cutting and other machinery, by adding the word *tool*?

Boston, Mass. WM. E. CHOATE.

In the shop the best sort of praise for a lathe or planer is expressed by calling it a good tool. A good lathe might be a poor tool, however, for some purposes.

An advertiser in the AMERICAN MACHINIST said: "For power, rigidity and efficiency our boring, facing and tapping machine is the tool." If tool is translated into German by *werkzeug*, then tool means more than a piece of steel providing the cutting edge. The German calls a lathe tool a turning steel. A drill may be driven by a brace or by a driller. Both the brace and the driller may be hand driven, but they serve the same purpose and are both tools. The difference between the two is, the driller by the number and complication of its parts rises to the dignity of being a machine and having the qualifications of being both a machine and a tool becomes a machine tool. I would define the meaning of tool always as a means to an end, and a shop tool as the mechanical means to a mechanical end.

The word *werkzeug* by its construction means a make-up or rigging to work with. When applied to small tools it means the aggregate. The hammer or the punch is simply a piece. Supposing a lathe or a planer is a tool, and suppose this tool is used to machine castings and forgings, why not call it a machine tool?

High Bridge, N. Y. J. SCHURING.

Bronze versus Bronze and Cast Iron Boxes

The Queen City Machine Tool Company asks me to comment on their article about their way of making the bearings of their shapers. It seems to me that their way of securing perfect alinement cannot be questioned. Whether their method of securing perfect lubrication is better than the grooved shaft experience, under absolutely like conditions, (which is hardly possible), I could not tell as both the Steptoe and Queen City report absolute satisfaction after a number of years' experience. It leaves the question to be determined by a longer experience in a larger number of cases.

Of course, every one with nothing but judgment to guide them would say that a hardened and ground shaft was superior to a soft one, but from our experience with hardened and ground crosshead pins in babbitt boxes compared to cast-iron ones, I am sure that the hardened and ground journal has no merit except as a selling point; as a bearing in a babbitt box it is a dead failure. Mr. LeBlond has demonstrated by experiments and experience that a cast-iron box is the best of all. My own belief is that oiling through the center of the shafts is the best of all ways to get the oil to the journal and with the exercise of some gumption, oil can be made to reach any number of separate gears or pulleys on the same shaft.

This method of managing the oil is what we have always used in the main bearings of the Straight Line Engine and the same as I gave when describing the device in *Engineering* in 1868.

About the taper gib—I never ran across the experience that the thin end of a taper gib wore the most. I can understand why one end of a gib should wear faster than the other, but why only the thin end, unless it so happens?

A long slide such as a shaper ram in a short guide, or a short slide as the head on the cross rail of a planer are dead sure to wear more at one point than at another, and it's sure to do this on the gib the same as it would on any other member. If the thin end of the gib is on the right end to receive the wear, it's sure to be the thin end that wears, but if the thick end is exposed to the wear, why should the thin end wear? However, why do the machine-tool builders persist in furnishing machines that have unequal wearing surfaces? Of course, no planer can have two heads six feet wide on a six-foot cross rail, but where the rail wears the least, causing the heads to be loose at one point and tight at another, the bearing surfaces can be cut away in such a manner as to make the wear more nearly, if not absolutely uniform. If this were done I question if the taper gib would have any excuse for wearing most at the thin end; in fact when we have equalized the wear, surprising as it may seem, there is hardly any use for the gib at all. In fact it is the undisputable evidence that "the thing that does not tend to wear out of true doesn't wear much."

Syracuse, N. Y. JOHN E. SWEET.

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American Machinist

Do Rest Periods Pay?

While we smile indulgently at the European notion of afternoon tea in offices, as well as in the homes, it is just possible that we may some of these days learn a lesson in this line from our friends across the water. Physicians and others who have studied the problem of using human energy to the best advantage are coming to believe that a period of relaxation during the working periods, even without the tea and crackers, may after all be a real economy and a means of securing more work with less fatigue on the part of the workers.

There are a number of large offices where a short period of rest is taken both morning and afternoon, with an increase in the quality and quantity of work, and it is quite possible that a similar result might be secured in the shop.

We can learn much from careful studies of the effect of steady or intermittent action of muscles, just as in the case of Mr. Taylor's study of the pig-iron handler, and periods of enforced rest may prove a direct gain to all concerned.

While there is no likelihood of pink teas in the foundry for several weeks to come, it may be well to carefully consider whether two rest periods, of perhaps 10 minutes each during the day, might not secure the same output with greater accuracy of the product and leave the men in better condition than before.

But let us realize that it is a purely economic question and not attempt to brand it as welfare work with even a tinge of philanthropy about it. Let us remember that unless changes of this kind benefit both parties involved, they are not likely to be of much value or of long duration.

Navy Yard Reform

Many years ago Herbert Spencer, writing of the British dock yards said: "Walk through a manufactory and you see that the stern alternatives, carefulness or ruin, dictate the saving of every penny; visit one of the national dock yards and the comments you make on any glaring wastefulness are carelessly met by the slang phrase—'Nunky pays.'"

This description applies today with equal force to the navy yards of the United States. A visit by a competent engineer or manager to one of these yards will cause him to hang his head in shame—shame that the Government which he calls his own allows such waste of the people's money. Shame that the engineering profession of which he is proud should not be recognized, in that, those in authority by their actions proclaim that management and engineering are not live professions, but can be taken up as a side issue by officers of the navy when not occupied with their duties aboard ship.

Another of Spencer's truths is also applicable. It is: "Gray hair or a title is a far better guarantee of naval promotion than genius is. Nay, indeed, the man of capacity often finds that in government offices superiority is a hindrance—that his chiefs hate to be pestered with his proposed improvements and are offended by his implied criticisms. Not only, therefore, is legislative machinery complex, but it is made of inferior material."

In our own country we find officers placed, because of their rank, in positions of great responsibility, and in trying to perform their duties, they attempt to direct industrial operations for which they have neither ability nor training. On the other hand, we find officers with ability and experience in handling industrial work either put aside or given subordinate duties. This is no doubt due to what has been called "the villany of government"—a situation "where there is no direct connection between the profit obtained and the work performed; where birth, age, rank, backstairs intrigue, or sycophancy determines selections rather than merit."

The gross inefficiency of the navy yards is now attracting attention. Engineers, managers and even the general public are learning of the millions of dollars that are wasted. There is also a realization that as the navy grows larger these wastes will also grow, and that soon they will become a serious drain on the country. There is a demand among men of the engineering profession and in manufacturing pursuits that these conditions should be remedied, and that the administraion of navy yards should be made efficient. Unless this demand is heeded there is little doubt that the people, through Congress, will demand an accounting and a remedy.

There are signs that the demands for reform will be heeded; even now the Navy Department is making preliminary preparations to take action towards improvements. The employment by the Secretary of the Navy of a commission of civilian experts, consisting of Messrs. Gantt, Emerson and Day to investigate the navy yards, and prepare for the secretary a scheme of organization, and outline the improvement that should be

made, is an excellent step for which Mr. Meyer should be commended.

This commission has a most important duty. Its members should meet the issue squarely and courageously, and report to the secretary the conditions as they actually exist. They should outline to him an organization and scheme of management which will make the navy yards efficient industrial establishments. We have no doubt that the commission will perform its duties well, but we fear that many of the recommendations which the members desire to make will be in opposition to some of the views on management expressed by the secretary and his aides, and will also be opposed to the wishes of naval officers. It is hoped that these conditions will not influence the members of the commission to leave truths untold which the secretary, Congress and the country should know. The engineering profession through this commission has one of its very few opportunities to do a great public service, as well as a service to the navy, and the utmost should be made of this opportunity.

The AMERICAN MACHINIST does not wish to engage in destructive criticism, but on the contrary has an earnest desire to assist in improving the administration of the yards, considering this a patriotic duty, as well as a duty to the engineering profession and the machine-building industry.

How Well Can We See the Work

During the long summer days is the time to think about and prepare for the lighting of the shops, drawing room and office during the coming winter. And it is safe to say that the lighting question deserves much more careful attention than it usually receives.

But even when we do consider it, we are all too apt to think only of candle power and the kind of lamps, when the main question is, how *well* can you see?

When it comes to the tool and drafting rooms there are a few pertinent questions which we may well ask ourselves. Can we see to read the finest divisions of a scale that we have occasion to use, at every point in the room where we need to use it, or is it necessary to go directly under a lamp in order to do so?

!Can we see to read blueprints or sketches clearly, so as to avoid the danger of making mistakes in lines or dimensions, or can we clearly see all scriber marks on bright metal surfaces, such as laying out dies? Unless we can do this we must either waste time in going to a bright spot in the room, or run the risk of making mistakes, which will cost many times more than the extra light required to prevent it.

It is not, however, a question of the quantity of light as much as its quality and distribution. There is often more light than is necessary, but it is so located as to dazzle the eye or throw a glare in certain spots, leaving others in a dark shadow, both conditions being unnecessary with proper attention to distribution.

We have become so accustomed to getting along with insufficient or improperly distributed light that we hardly realize what it means in the way of delaying production and increasing the number of accidents during the winter months. But, when we look into the matter fully, it will be seen that the extra cost both for equipment and current, bear a comparatively small proportion to the increased output both in quantity and quality, which can be secured by proper lighting. Shops can be so lighted that we may see as well by artificial light as by daylight, and when we get this idea firmly fixed in our mind, we will not be content with anything else. For, unless we can see all the fine points of our work by artificial light and can work by it as long as necessary without straining the eyes more than by daylight, we are not providing the best condition for ourselves or our employees or our product.

And while it may not be easy to show the increased output in dollars and cents, it must be evident that such a difference exists and there can be no question as to its effect on the work and the men employed.

NEW PUBLICATION

STEAM TURBINES. By Joseph Wickham Roe, M. E. Published by McGraw-Hill Book Company, New York, 1911. Cloth; 143 pages; illustrated. Price, $2.

The author, who is assistant professor of mechanical engineering at the Sheffield Scientific School, Yale University, has produced an excellent little work adapted to the needs of the engineer who wishes to inform himself on the principles and general design of turbines as well as for a textbook for a short course upon the subject. He who has wondered what all the velocity diagrams and velocity-pressure schemes so often published in connection with turbine discussions mean will find them explained here in all simplicity, requiring the possession of only a little elementary trigonometry for their comprehension. Each division of the subject is followed by a list of practical examples, the solution of which requires the application of the principles which have been explained and the use of the formulas deduced, and a list of references to other works for those who wish to pursue the phase of the subject further.

The first chapter is devoted to the explanation of the energy in a jet. The second chapter deals with the utilization of the kinetic energy in steam and shows by means of the velocity diagram how this energy is absorbed by the wheel. The method of finding the trajectory of the steam is also explained. About 30 pages are then devoted to "Calculations of Turbine Blading."

Under the title of "Mechanical Problems," the author takes up centrifugal strains, but says little or nothing of critical speeds and balancing. Bearings and governing are treated in this section.

Chapter V is hardly a "Comparison of Types," but a description of the Curtis vertical, Terry, Kerr, Rateau, Zoelly and Allis-Chalmers machines, and of the Rateau regenerator and mixed-flow turbine.

The effect of superheat and vacuum, but not of pressure, is considered in the next chapter, which contains also a description of the Parsons augmentor. The concluding chapter deals with "The Position and Field of the Steam Turbine."

PERSONALS

E. Burton Smith, who has been connected with the Newark plant of the General Electric Company, has been appointed superintendent of the Toledo lamp works of the same company.

H. J. Freyn, until recently assistant engineer of construction of the Illinois Steel Company, South Chicago, Ill., has become consulting engineer in the gas-engine department of the Allis-Chalmers Company, West Allis, Wis.

Frederick Bucher, formerly general small-tool supervisor of the American Locomotive Company, has accepted a position as demonstrator for the mineral lard-oil department of the Union Petroleum Company, Philadelphia, Penn.

Frank G. Payson, for the past six years traveling mechanical expert for the Niles-Bement-Pond Company, New York City, has accepted a position as western representative for the Union Petroleum Company, Philadelphia, Penn., with headquarters at Chicago, Ill.

Frank W. Hall has been appointed manager of hoist sales of the Sprague Electric Works, with headquarters in New York. Mr. Hall was formerly manager of the Philadelphia office of the same company, where he will be succeeded by James A. Clifford, formerly manager of the Baltimore office.

OBITUARY

W. L. De La Fontaine, vice-president of the Chicago Motor Company, was instantly killed in an automobile accident near Elkhart, Ind.

E. R. Evinger, superintendent of the Miami Valley Machine Tool Company, Dayton, Ohio, died on June 19, after an illness of about six months. Mr. Evinger was 37 years old.

Shop Equipment News

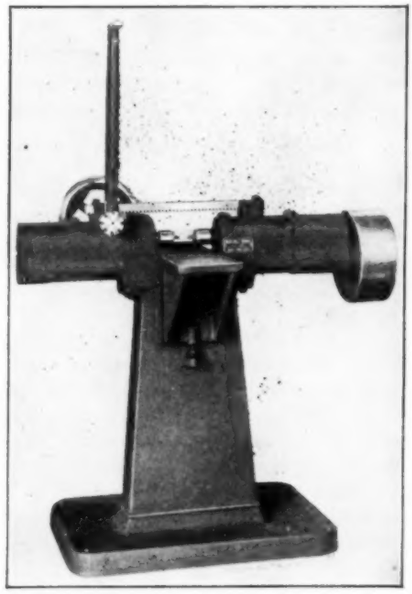
New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Pipe and Channel Duplex Driller

The accompanying halftone shows a small driller built on the duplex principle, now being developed by the Moline Tool Company, Moline, Ill.

The spindles are hollow and provided with chucks for holding straight-fluted drills. Inside of the spindle is a threaded rod to prevent the drill from forcing back and to set it out any distance required to pierce the wall of the pipe or the side of the channel. The tables are vertically adjustable to suit different hights of jigs, the only jig required being fixture for holding the piece to be drilled in place and a notched or drilled bar for spacing the holes; no drill bushings or guides are required.

The spindles run in bronze bushings, are provided with ball-thrust bearings



PIPE AND CHANNEL DRILLER

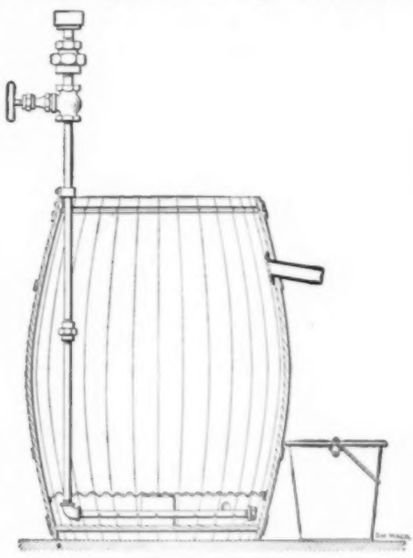
and are driven by steel spur gearing. This machine will take drills up to about 5/8 inch, and its design is such as to permit the operation of high-speed drills to their capacity. It can be used in pipe up to 3 inches in diameter.

Rapid production is effected by the fact that the drills operate simultaneously from both sides and it will be appreciated that the design also tends to eliminate drill breakage. Another feature of this type of machine is that due to the fact that all of the drilling is done from the outside, the burs are all on the inside where they require no alteration.

Cleaning Waste and Saving Oil

The arrangement shown by the accompanying figure has been suggested by the Oakley Chemical Company, New York, in connection with its sale of "Oakite," a compound of salts useful in cleaning waste and saving oil.

The barrel shown is filled half full, with water, 25 gallons, with 2 pounds of Oakite, and with about 20 pounds of dirty, oily waste or rags. These are soaked 15 minutes in the water made tepid by means of the steam pipe passing into the barrel, and under the screen shown at the bottom. Then the water is brought to about 180 degrees Fahrenheit, and permitted to remain at that temperature for about 20 minutes. In the meantime, the waste is stirred vigorously so that the oil freed by Oakite will rise to the surface. As the oil accumulates on the surface, enough water is added to raise the level of the oil to the spout, so that the oil will run off. When the surface is free from oil, the waste is taken out and dropped into a rinsing tub containing ½ pound of Oakite to 10 gallons of clean water. An ordinary clothes wringer facilitates the drying.



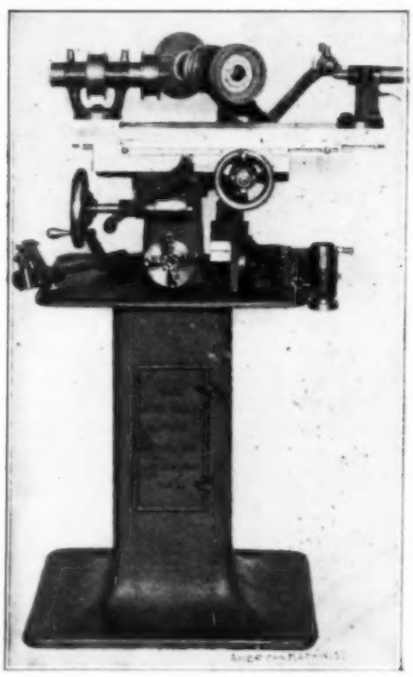
CLEANING WASTE AND SAVING OIL

Waste, cloth, or rags, smeared with grease, oil, paint, etc., can be cleaned in this manner, and used repeatedly.

Universal Tool and Cutter Grinder

The accompanying illustration shows the latest design of universal tool and cutter grinder and plain cutter and reamer grinder, brought out by the Miami Valley Machine Tool Company, Dayton, Ohio.

The square pedestal with tool shelf affords convenient shelf room, on which to lay work, and the cupboard furnishes ample space for the storage of all attachments of machines as well as supplying additional weight.



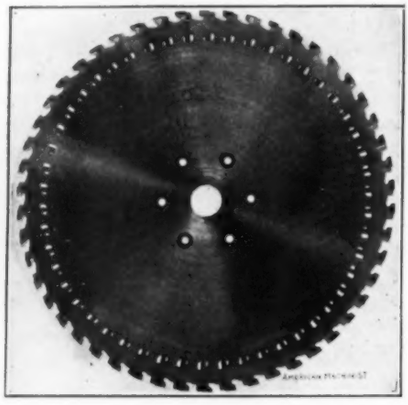
UNIVERSAL TOOL AND CUTTER GRINDER

The general design and operation of the machine is similar to the builder's regular line, which has been previously shown in these columns.

Inserted Tooth Saw Blade

The accompanying halftone shows an inserted-tooth saw blade for cutting bars, forgings, steel castings, rails, frogs and switches, recently placed on the market by the Hunter Saw and Machine Company, Pittsburg, Penn.

The body of blade is made of vanadium alloy tool steel, while the teeth are made of high-speed steel, and both hardened and treated.



INSERTED-TOOTH SAW BLADE

The teeth are secured by interchangeable tool-steel wedges, lowered to brass adjusting screw, so as to have each tooth exactly the same hight. It has a large number of teeth, which is advantageous in cutting some of the smaller sections.

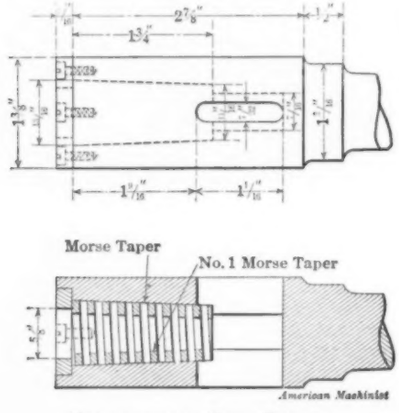
This blade has been thoroughly tested on 0.61 carbon-steel splice bars, making 1275 cuts in 65½ hours, at a lateral feed of 9/16 inch per minute, bars being piled four high, at the end of which test the teeth were in excellent condition, and were as rigid as when first placed on machine.

Compression Grip Socket

The illustration herewith shows the detailed construction of a grip socket for taper-shanked drills, reamers, etc.

Taper-shank tools, the tangs of which have been broken, are firmly held and driven by this socket. The socket is made of steel and the coiled steel grip is tempered and ground to correct taper inside and out. As will be readily seen, the socket works on the principle of the coil clutch.

It is made by McFarlane & Little, 15 N. Seventh street, Philadelphia, Penn.

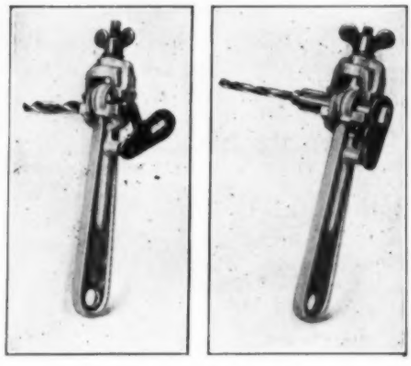


COMPRESSION GRIP SOCKET

Quick Acting Drill Holders

The first drill shown in the accompanying halftone has a floating center and will hold drills from ¼ to ¾ inch diameter with straight or taper shanks. The construction is readily seen from the illustration. The gib is powerful, while the shanks are protected from holding marks.

The second holder is shown holding a drill with taper shank. It is provided with swiveling tongue dog as well as a floating center.



QUICK-ACTING DRILL HOLDERS

These holders are manufactured by the Krieger Tool and Manufacturing Company, Grand Rapids, Ill.

Mounting Ball Bearings on Shafts without Shoulders

Occasionally, the need arises to alter an existing machine to apply ball bearings in place of plain bearings formerly used. A very simple and effective way to do this is shown in the accompanying drawings. It originates with the Hess-Bright Manufacturing Company, and was devised for use in connection with the "H B" and "D W F" bearings. The same arrangement is applicable also to any machine, the shaft diameter of which cannot be increased by shoulders.

Fig. 1 shows the method applied to a radial bearing of standard Hess-Bright type.

In Fig. 2, the split bush is shown in a form adapted to a thrust bearing.

Fig. 3 shows a mounting for both radial and thrust bearings. The bush is split and both races are lightly pressed home.

In Figs. 2 and 3, a constant end thrust is assumed; if the shaft backed away from the thrust bearing, the ball-seated thrust washer would drop, and would be damaged by shock and unequal contact when the thrust was resumed. If, from the nature of the work, the thrust is intermittent, the shaft must be held against the thrust bearing by definite mechanical means.

In all cases where a ball-thrust bearing is used on a horizontal shaft, it is essential that the alinement of the shaft be positively maintained. If the shaft is supported by plain radial bearings, the wear of these bearings will allow the shaft to settle till it is out of center with the thrust bearing. This will result in the destruction of the latter. Where the shaft is not otherwise supported in the neighborhood of the thrust bearing, the construction shown in Fig. 3 should be used, as this insures the shaft's remaining concentric with the thrust bearing.

Soldering Cast Iron

Cast iron can readily be soft soldered if the following instructions are followed. Make an amalgam of tin filings and mercury. What is not used at once can be kept in a wide-mouthed glass bottle for future jobs.

The joint is first cleaned thoroughly, then a clean rag is dampened with commercial muriatic acid and some of the tin mercury amalgam is rubbed well into the cleaned joint. Soldering is then proceeded with in the usual way, using Yeager's soldering salts as a flux.

A German correspondent writes: "Under the new patent law American builders have nothing to fear and for the next two years, which promise to be fat ones, there will be a good market for machines of first-class reputations.

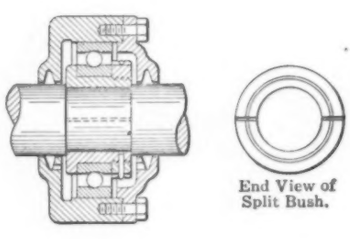


FIG. 1. MOUNTING FOR RADIAL BEARING

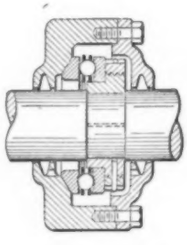


FIG. 2. MOUNTING FOR THRUST BEARING

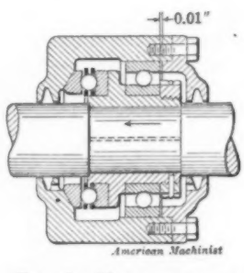


FIG. 3. MOUNTING FOR COMBINATION BEARING

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

Portland, Me., will extend its sewer system.

Eugene N. Foss will build a public garage on Beacon Street, Boston, Mass.

Alonzo Newton will build a garage on Front street, Holyoke, Mass.

The Fort Hill Bronze Company, Everett, Mass., will enlarge its plant.

The Bridgton Machine and Lumber Company, of Bridgton, Me., will build an addition to its machine shop.

McCrum-Howell Company, Norwich, Conn., manufacturing heaters, radiators, etc., will build an addition to its plant.

The shop, foundry and power plant of the new Wentworth Institute, Boston, Mass., are nearing completion. New equipment is to be installed.

Boston & Albany Railroad has taken out permit to erect building in Worcester, Mass., to be used as shops and steam-heating plant for new station recently completed.

The McNab Company, Bridgeport, Conn., has been incorporated to manufacture and deal in machinery, etc. Capital, $50,000. Incorporators, H. A. Bishop, Norman Leeds, etc.

The Parker Transmission and Appliance Company, Springfield, Mass., has increased its capital from $250,000 to $1,000,000. A larger factory will be erected in the near future, probably at Detroit, Mich., location as yet not being definitely decided.

The Manville Brothers Machine Company, Waterbury, Conn., manufacturing wire-forming machines, has been purchased by Geo. Rowbottom, of the Rowbottom Machine Company. It is expected that a plant will be built in addition to the Rowbottom factory to accommodate it.

MIDDLE STATES

A new municipal waterworks system will be built at Oak Harbor, Ohio.

Dr. William C. Hollopeter is having a garage built at Merion, Penn.

The city of Detroit is contemplating the erection of a municipal garage.

The Grabowsky Power Wagon Company, Chicago, Ill., will enlarge its plant.

The Star Stoneware Company, Crooksville, Ohio, will build an addition to its plant.

The Ohio Valley Brass and Iron Company, Mingo Junction, Ohio, will build a new plant.

L. W. Hobble, of Hampton, Ia., is building a new garage and will need machine tools.

The Ross Motor Company, of Superior, Wis., will build an addition to cost $20,000.

The Union Fork and Hoe Company, Columbus, Ohio, is building an addition to its plant.

The Western Brass Manufacturing Company, of Chicago, Ill., is erecting a new foundry.

The Delaware (Ohio) Light, Heat and Power Company will make improvements to its plant.

The Denver City Tramway Company, of Denver, Colo., will erect a machine shop and garage.

The Vulcan Iron Works, Wilkes-Barre, Penn., has filed plans for its new four-story pattern shop.

The Borgerding Motor Car Company, of New Albany, Ky., will erect a garage and machine shop.

The garage of C. Schroeder, of 2545 Carlisle street, Philadelphia, Penn., was destroyed by fire.

The Kopmeier Motor Car Company, of Milwaukee, Wis., expect to build a $50,000 addition to its garage.

The Guerber Engineering Company, South Bethlehem, Penn., is building a new addition to its machine shop.

The Strong Steel Foundry Company, Buffalo, N. Y., has secured site on which a new plant will be erected.

The Ajax Forge Company, 2503 Blue Island Avenue, Chicago, Ill., has let contract for a two-story addition.

The Cross Gear and Engine Company, of Detroit, Mich., is planning to increase its manufacturing operations.

The Augustine Automobile Rotary Engine Company will build a factory at 1862 Elmwood avenue, Buffalo, N. Y.

The Felt & Tarrant Company, Chicago, Ill., manufacturing calculating machines, will erect a three-story addition.

The C. & D. Railroad has secured land at Boston, Ind., near Richmond, for the erection of a roundhouse and shops.

The Republic Metal-ware Company, 84 Tennessee street, Buffalo, N. Y., has filed plans for an $8000 factory.

A permit has been issued to William R. Dougherty to build a garage at 2026 Rittenhouse street, Philadelphia, Penn.

A permit has been issued to A. X. Phelan for an addition to a garage at Craig and Atherton streets, Pittsburg, Penn.

Fire that burned the marine repair shops of the West Shore Railroad, at West New York, N. J., caused a $100,000 loss.

A permit has been issued to James McCann to build a one-story garage at 1509 North Thirteenth street, Philadelphia, Penn.

A permit to build a garage at 8326 Seminole avenue, Chestnut Hill, Philadelphia, Penn., has been issued to F. F. Dixon.

The Bennett Register Company, of Lisbon, Ohio, recently organized, has started the erection of a factory on Lincoln avenue.

The Slatington Rolling Mills has succeeded the Slatington Rolling Mill Company, at Slatington, Penn. Will entirely overhaul plant.

The American Electrical Heater Company, Detroit, Mich., is finishing a large addition to its factory and will install new machinery.

A two-story garage will be built for L. Willard Mulford, at Nineteenth and Norris streets, Philadelphia, Penn., to cost $10,000.

Sperlich & Uhlig, machinists, Piquette avenue, Detroit, Mich., have moved into larger quarters and are to add new equipment.

The Mountain Garage, Verona, N. J., has been incorporated with $50,000 capital by Chas. I. Manning, J. E. Mullins, Wm. W. Crane.

The plant of the Elizabeth Street Foundry Company, Forty-ninth and Elizabeth streets, Chicago, Ill., was destroyed by fire. Loss, $10,000.

The Buckeye Iron and Brass Works, of East Third street, Dayton, Ohio, will soon start the erection of a six-story plant to cost over $10,000.

The Illinois Central Railroad Company will spend a half million dollars in building new roundhouses and other improvements at Champaign, Ill.

The Quinn Manufacturing Company, of Kalamazoo, Mich., will erect a large factory in Detroit. The concern manufacturers plumbers' supplies.

The Pere Marquette Railroad will build a new roundhouse and a new power station double the size of its present one in the Saginaw, Mich., district.

The Hayer Manufacturing Company, of Detroit, Mich., will erect a three-story factory, increasing their line of automobile sheet-metal parts and forgings.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 1 for two rapid-action punches as per Schedule No. 3720.

The Hatfield Company, maker of the Hatfield car, has moved its plant from Cornwall-on-the-Hudson to Elmira, N. Y., and is planning increased production.

A permit has been issued for the erection of a garage for the F. Mark Construction Company, on Twenty-first street, near Cambria street, Philadelphia, Penn.

The National Heater Company, of Detroit, Mich., has been incorporated and will start to manufacture shortly. E. G. Joy and S. W. E. Finlayson are the stockholders.

A permit has been issued for the erection of a one-story machine shop for Lewis A. Scott, on Mt. Vernon street, near Broad street, Philadelphia, Penn., to cost $8000.

Fischer Brothers & Corwin, Newark, N. J., have incorporated with $50,000 capital to manufacture hardware, etc. Incorporators, August Fischer, Wm. Fischer, Geo. F. Corwin.

The garage and repair shop of the Automobile Owners Association, at 1415 Diamond street, Philadelphia, Penn., was badly damaged by the explosion of a compressed-air tank.

The Wentworth Manufacturing Company has been incorporated and will manufacture the Wentworth automatic auto pumps. Offices are at 239 Jefferson avenue, Detroit, Mich.

The Lincoln Motor Car Works, Chicago, Ill., has been incorporated to manufacture automobiles, etc. Capital, $50,000. Incorporators, Sidney Adler, R. Berman, Chas. Lederer.

The Rochester (N. Y.) Watch Company

has been incorporated to manufacture watches. Capital, $500,000. Incorporators, F. H. Corthell, T. C. Ward, Rochester; E. R. Hills, Chicago.

The capital stock of the Standard Steel Company, of Cleveland, Ohio, has been increased from $40,000 to $100,000 to provide for additional facilities. C. R. Williams is president.

The L. Wells Company, Chicago, Ill., has been incorporated to manufacture motors, engines, etc. Capital, $10,000. Incorporators, C. C. Darnall, T. J. Shanahan, La Motte Wells, etc.

The Iowa Valve Company, Oskaloosa, Iowa, has been organized with $100,000 capital to manufacture valves. B. N. Boss, Des Moines, president; Herman Read, Oskaloosa, secretary-treasurer.

The Oakes-Enders Company, Indianapolis, Ind., has been incorporated to manufacture auto parts and accessories. Capital, $10,000. Incorporators, Wm. H. Oakes, H. J. Enders, E. G. Enders.

The Miller Scale Company, East Orange, N. J., has been incorporated to manufacture scales, weight machines, etc. Capital, $50,000. Incorporators, H. H. Picking, C. O. Geyer, F. E. Ruggles.

The American Keyless Lock Company, Chicago, Ill., has been incorporated to manufacture locks, hardware, etc. Capital, $50,000. Incorporators, E. L. Bernard, Frank J. Reed, W. H. Kentnor.

The National Foundry Company, Detroit, Mich., has been incorporated with $25,000 capital to engage in general foundry business. Incorporators, J. B. Fleming, H. A. Crawford, J. W. Martin, etc.

The Lafayette (Ind.) Safe and Lock Company has been incorporated with a capital of $25,000 by George Jenks, Ferdinand Dryfus, I. I. Schultz and S. S. Washburn to do a manufacturing business.

The Arthur Machine Company, Richwood, Ohio, has been organized with $20,000 capital to manufacture and sell gasolene engines and other machinery by George G. Arthur, Carl E. Zeeg, Edward J. Tobey, etc.

The Kultgen Nichol Foundry Company, Chicago, Ill., has been organized with $10,000 capital to conduct a general foundry and machine shop. Incorporators, John D. Kultgen, John G. Nichol, N. J. Johnson.

The Blackstone Manufacturing Company, Toledo, Ohio, has been organized with $50,000 capital to manufacture all kinds of metal specialties by Philip W. Evans, Henry A. Huttinger, George F. Grimm, etc.

Meech Foundry and Casting Company, Cleveland, has been incorporated to manufacture metal specialties and do a general foundry business by P. D. Crane, M. D. Crane, P. R. Mooren, etc. Capital, $15,000.

The Standard Pressed Metal Company, Camden, N. J., has been organized to manufacture and construct metal work of all kinds. Capital, $500,000. Incorporators, Ray G. Kissinger, Clarence N. Haven, Chas. F. Woodhull.

The Akron Taxicab and Transfer Company, Akron, Ohio, has been incorporated to operate a taxicab concern and garage, including repair business, by Charles E. Mills, Harry B. Rosston, Robert Henry, etc. Capital, $30,000.

The Pittsburg & Lake Erie Railroad Company has commenced erection of new large wood car-repair shops on Davis island. L. H. Turner, superintendent of motive power, McKees Rock, Penn., will have charge of the new shops.

The Star Engineering Company, Cleveland, Ohio, has been organized with a capital of $10,000 to do a general machine and engineering business. Incorporators, Frank Svoboda, Edwin Petanek, Herman Zluban, Cornelius J. Kelly, etc.

The Automatic Signal and Appliance Company, Cleveland, Ohio, has been organized with $10,000 capital to manufacture and sell automatic signals for railroads and electric lines. Incorporators, W. G. Green, Harrison B. McGraw, M. H. Gallagher, etc.

Forsyth Brothers, 213 Institute place, Chicago, Ill., have completed a new building at Harvey, Ill., to manufacture railroad supplies. Are installing new machinery to make steel car doors, window sash and interior finishings. The plant will be run by electricity.

The Cornell Construction Company, Cold Spring, N. Y., has been incorporated to manufacture machinery and material used in construction and engineering work. Capital, $100,000. Incorporators, Charles P. Howland, 35 Wall street; L. Vincent Lockwood, 35 Nassau street, New York, etc.

The Jenny Company, manufacturer of electrical apparatus, of Anderson, Ind., will sell out to a new company, including Victor Lawson, William Waller, William Waller, Jr., of Chicago, and Warren C. Fairbanks, of Indianapolis, etc. The plant under the new management will be enlarged and doubled in capacity.

WEST OF THE MISSISSIPPI

W. H. Smith, Portland, Ore., will build a new commercial garage and repair plant.

C. F. de Corse, Los Angeles, Cal., has taken out a permit to build a new machine shop.

A. D. McDougall, Portland, Ore., will build a commercial garage and repair plant.

The Oklahoma Iron Works, Tulsa, Okla., is erecting a new foundry and blacksmith shop.

V. A. Billion, Portland, Ore., has taken out a permit to build an addition to his machine shop.

The plant of the Sylvia Shingle Company, Montesano, Wash., was destroyed by fire. Loss, $50,000.

The Globe Iron Works, foundry and machinists, Stockton, Cal., has commenced work on a new plant.

W. L. Rhoades, Seattle, Wash., is having plans prepared for a commercial garage and repair plant.

The Grandjean Gas Machine Company, San Diego, Cal., has taken out a permit to build an addition to its plant.

The Couch-Cole Aëroplane Manufacturing and Exhibition Company plans the erection of a factory at Des Moines, Iowa.

E. F. Benson, Tacoma, Wash., will build a commercial garage and repair shop. Modern machinery will be installed.

Machris Brothers, Hoover street, Los Angeles, Cal., are having plans prepared for a commercial garage and repair plant.

The Phoenix Iron Works, Portland, Ore., has taken out a permit to make additions and improvements in its foundry plant.

The Inland Empire Biscuit Company, Spokane, Wash., will build a garage and repair plant for the care of its automobiles.

The International Tool Company, of Los Angeles, Cal., will locate at Krebs, Okla. The company manufactures pipe wrenches, etc.

George Arndt and Frank Warren, Lincoln, Cal., will build a commercial garage and repair plant. Modern machinery will be installed.

The Pacific Electric Railway, Los Angeles, Cal., has purchased property at Homeward avenue and plans for the erection of new car shops.

The machine shops and roundhouse of the Santa Fe Railroad, Barstow Cal., were destroyed by fire. Loss, including locomotives, $750,000.

Kelley Brothers, Incorporated, Portland, Ore., has been organized to engage in the sheet-metal-working industry. H. L. and M. G. Kelly, incorporators.

The Duluth, Winnipeg & Pacific Railway will build a 10-stall round house, machine shop and boiler room, at Duluth, Minn. H. T. Hazen, chief engineer.

The Delaware Union Oil Company, Anaheim, Cal., plans to build a large blacksmith and carpenter shop in the near future. The plant will be fully equipped.

The Howard Auto Switch Company, Eugene, Ore., will build a plant for the manufacture of a patented switch. Modern machinery will be installed.

The Southern California Edison Company, Los Angeles, Cal., light and power, has taken out a permit to build an addition to its repair shop on Railroad street.

The Kern County Board of Supervisors, Bakersfield, Cal., is planning for the erection of a mechanical arts school building. The school will be fully equipped with necessary equipment for study.

The Oregon-Washington Railroad and Navigation Company will build a group of seven repair-shop buildings at Argo, Wash. The contract for the erection of building has been awarded. J. S. Farrell, Seattle, general manager.

The Crippen Improved Thresher Company, Wichita, Kan., has been formed with $200,000 capital to manufacture a patented threshing machine. H. C. Warner, Arlington, Kan., president; R. W. Crippen, Arlington, vice-president.

Fire destroyed the plant of the Lennox Machine Company, at Marshalltown, Iowa, causing a loss of about $112,000. This was controlled by Jos. Ryerson & Sons Company, of Chicago. Sheet-metal working machinery was manufactured.

CANADA

The Galt Foundry Company, of Galt, Ont., will double its plant.

The Enterprise Foundry Company, of Sackville, N. B., will double its plant.

The Ontario Spring Bed and Mattress Company, of London, Can., will double its plant.

The George White Manufacturing Company will equip a new $30,000 foundry at London, Ont.

The Underground Cable Company, of Pittsburg, will build a new $100,000 factory at Hamilton, Ont.

The Boston Insulated Wire and Cable Company will locate a new $500,000 plant in Hamilton, Ont.

Messrs. Emerson and Fisher, of St. John, N. B., will make big extensions to their foundry at Sackville, N. B.

General Manufacturing

NEW ENGLAND

Waterville, Me., will extend its water system.

Montpelier, Vt., will improve its water system.

Williamsburg, Mass., will extend its water system.

Winsted, Conn., will construct a sewer system.

Worcester, Mass., will extend its sewer system.

Fitchburg, Mass., will extend its sewer system.

North Haven, Me., will improve its sewer system.

Charlestown, N. H., will extend its water system.

Westport, Conn., will install boilers at its power house.

Milford, Mass., contemplates extending its sewer system.

Mansfield, Mass., will improve its municipal electric-light plant.

The Bigelow Carpet Company, London, Mass., will erect a new dye house.

Shelbourne Falls, Mass., has received State permit to install new water supply.

The Winsted (Conn.) Hosiery Company will build an addition to its plant.

The shoe factory of George W. Bolonga, Lynn, Mass., was badly damaged by fire.

Forbes Lithographic Company, of Chelsea, Mass., will build an addition to its plant.

Sutton Manufacturing Company, North Andover, Mass., will install two new boilers.

The Bay State Stone and Brick Company, of Springfield, Mass., will build a new factory.

John F. Meehan (stone yard) will build an addition to his plant at New Britain, Conn.

The American Sugar Refinery Company will build new power house at South Boston, Mass.

A. C. Lawrence Leather Company, of Peabody, Mass., will build an addition to its plant.

The United States Finishing Company, of Norwich, Conn., will build an addition to its plant.

East Hartford, Conn., has voted $60,000 bonds for the purpose of extending its water system.

The Bay State Brick and Stone Company, Springfield, Mass., is to erect a factory in that city.

Extensive alterations are being made at the plant of the Royal Chemical Company, Harris, R. I.

The O. D. Brett Lumber Company's plant, Lynn, Mass., was badly damaged by fire. Loss, $50,000.

The Isaac Prouty Shoe Company, Spencer, Mass., is to equip its plant with 41 motors and generators.

The plant of Young & Kimball, oil refiners, New Bedford, Mass., was badly damaged by fire. Loss, $60,000.

The factory of the Colonial Bed Company, Chelsea, Mass., was damaged by fire to the extent of about $15,000.

Lewis B. Utley, manufacturer of leather novelties, will install new machinery in his factory at Holyoke, Mass.

A dye house to replace the one burned some months ago is to be built by J. D. Clark & Co., Rochdale, Conn.

Contract has been let for new boiler house at the Backus hospital, Norwich, Conn. Three new boilers will be installed.

The Farley Paper Company, Farley, Mass., will erect two additions to its plant, same to be used for the coating of paper.

The Dwight Manufacturing Company, manufacturers of cotton goods, of Chicopee, Mass., will erect a new plant, to cost $250,000.

The B. & R. Rubber Company, North Brookfield, Mass., is to increase capital stock $100,000 to be used for increasing equipment of plant.

William Skinner & Son Manufacturing Company, Holyoke, Mass., will erect a new mill in addition to its present plant. They manufacture silk linings, etc.

R. S. Peck & Co., Hartford, Conn., has been incorporated to do printing, engraving, etc. Capital, $30,000. Incorporators, Charles E. Peck, H. P. Peck, B. M. Holden.

The Climax Company, Montville, Conn., recently incorporated, is equipping part of the Thames River Specialties Company's plant in that town for the manufacture of cartons and paper retainers.

Alvi T. Baldwin, head of the Walpole (Mass.) Rubber Company, manufacturer of seamless rubber goods, has purchased a tract of land in Providence, R. I. It is reported that a large factory will be erected.

MIDDLE STATES

The Milligrove (Ind.) Bottle Company will move to Upland, Ind.

The Toledo (Ohio) Furnace Company is to erect a large coke plant.

Fire destroyed the factory of the Knapp Chemical Company, Jersey City, N. J.

Bedford, Ohio, will spend $45,000 for a sewage-disposal plant and a water system.

The Village of Grosse Pointe, Mich., is contemplating increasing its water system.

Fire destroyed two grain elevators of McFadden & Co., Havana, Ill. Loss, $40,000.

An addition will be built to the plant of the Main Belting Company, Philadelphia, Penn.

Alex. Dufresne, of Wausaukee, Wis., is planning the installation of an electric-light plant.

The city of Newcastle, Ind., is building an auxiliary water pumping plant in its factory district.

The Carey brick plant at Newton Hook, N. Y., badly damaged by fire, will be rebuilt at once.

The Saginaw Optical Company will open a factory in Saginaw, Mich., and will need equipment.

Fire partially destroyed the plant of the Forest City Electric Company, of Cleveland, Ohio. Loss, $5000.

The village of Middleport, N. Y., is considering the expenditure of $45,000 for a waterworks system.

Kern & Burchett, manufacturers of slack barrels, at Columbus, Ind., will move their plant to Vevay, Ind.

John F. White Canning Company will build a branch factory at Mount Morris, N. Y., having purchased a site.

The Standard Wall Paper Company, Hudson Falls, N. Y., is building an addition to its plant on Allen street.

The Indianapolis Paint and Color Company, Indianapolis, Ind., suffered a recent fire loss estimated at $50,000.

The plant of Justus Brauer & Co., cork manufacturers, 129 Arch street, Philadelphia, Penn., was damaged by fire.

The Union Gas and Electric Company, of Cincinnati, Ohio, is planning to build a $150,000 plant in the near future.

The South Bethlehem (Penn.) Brewing Company will make further additions to its power and refrigerating equipment.

The Junod Milling Company, Athens, Ohio, has been incorporated with $20,000 capital by L. F. Junod, H. A. Junod, etc.

A new central power plant will be built at Tuskegee College, Tuskegee, Ala. W. G. Franz, consulting engineer, Cincinnati, Ohio.

The Continental Sugar Company is planning an $800,000 plant, at Toledo, Ohio. J. F. Harper, of Cleveland, is president.

The Chilton Printing Company is having an addition built to its factory at Forty-ninth and Market streets, Philadelphia, Penn.

A part of the plant of Lieb & Artman (lumber and box manufacturers), Evansville, Ind., was burned with a loss of about $20,000.

At Akron, Ohio, the Buckeye Rubber Company will soon start the erection of an addition to its plant which will be five stories high.

The water committee of the city council, of Rushville, Ind., has decided to greatly increase the present capacity of the city water plant.

The Willys-Overland Company, of Toledo, Ohio, will build a five-story woodworking building. Modern machinery will be installed.

The Smithville, Mich., Egg Case factory is being greatly enlarged. The power plant is to be rebuilt also and new turbine equipment installed.

The Southwestern Telegraph and Telephone Company, Mansfield, Ohio, will rebuild its plant. New switchboard and cables will be installed.

The Tell City Furniture Company, Tell City, Ind., is building a $20,000 addition to its factory, which will increase its capacity 25 per cent.

The Cadillac Chair Company, of Cadillac, Mich., has been organized and will start to manufacture as soon as factory is completed. D. D. Kelly, president.

Bids will be advertised for a new heating plant for the Butler County court house, Hamilton, Ohio, cost not to exceed $10,000. Geo. Barkman, architect.

The Cincinnati (Ohio) Ice Company will build a producing and distributing plant at the corner of Park avenue and the C. L. & N. Railway Company tracks.

The Sprague, Walch Manufacturing Company, of Detroit, Mich., maker of auto lamps, has moved into its new factory and is preparing to increase output.

The Quaker City Morrocco Company, Camden, N. J., will build a new factory in Philadelphia, Penn. It will be in the market for new engines and boilers.

The Salem Tanning Company (tanners), Salem, Ind., has been incorporated with a capital of $10,000 by M. E. Taylor, J. F. Gamble, D. A. Kellar and H. Burgess.

Plans have been completed for a $50,000 power house to be erected by the Philadelphia Electric Company, at Twenty-Sixth and Christian streets, Philadelphia, Penn.

The Marquette, Mich., municipal water power and electric-light plant is being enlarged and new equipment will be needed. The waterworks is also being enlarged.

The Greater New York Brick Company, New York, has been organized with $100,000 to manufacture brick, etc. Incorporators, G. W. Washburne, Robert Main, Saugerties, N. Y.

The Hanna Paint Manufacturing Company, of Columbus, contemplates the erection of a new plant on Water street, near Long street. The plans for the plant are now being prepared.

The factory building occupied by Mellor Brothers, manufacturers of damask materials, at Rhawn and Franklin streets, Franklin, Philadelphia, Penn., was badly damaged by fire. Loss, $20,000.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids July 11 for files, pneumatic hammers, pad locks (schedule 3725), sheet brass and copper (schedule 3727).

The Columbus Auto Top Company, Columbus, Ohio, has been incorporated with $10,000 capital to manufacture tops and other accessories for motor cars. Incorporators, John Oswald, L. D. Davis, etc.

The Teegarden Brick and Tile Company, South Bend, Ind., has been incorporated with a capital of $20,000 by W. B. Calvert, D. G. Miller, T. E. Kinzie and W. C. Divine, to do a manufacturing business.

The County Electric Company, New Philadelphia, Ohio, has been organized with $700,000 capital to manufacture electric current for all purposes by S. L. Londen, H. K. Cravener, L. H. Purcell, etc.

Estimates are being prepared for a new factory building for A. J. Cameron & Co., manufacturers of yarns, to be erected at Pacific street and New York division, Pennsylvania Railroad, Philadelphia, Penn.

The Fletcher Realty Company, Indianapolis, Ind., will build a handsome 21-story office building on East Washington street, on the site of the old Fletcher Bank building. A complete power plant will be installed.

The Meerschaum Company of America, manufacturer of meerschaum and briar pipes, will move its plant from New York City to Ogdensburg, N. Y. A building has been acquired, and new machinery will be installed.

The Trumbull Public Service Company, Warren, Ohio, has been incorporated to manufacture artificial gas and electricity for commercial purposes. Incorporators, Ellis D. Deihm, E. E. Owens, Harold F. Clark, etc. Capital, $10,000.

It is expected that the erection of the new Ritz-Carlton hotel, at Broad and Walnut streets, Philadelphia, Penn., will begin within a month. The building will be 12 stories and will include a power, heating and refrigerating plant.

The plant of the Kenton Gas and Electric Company, of Kenton, Ohio, has been sold to the Hardin-Wyandotte Lighting Company for $165,000. Work on a new plant to cost $60,000 by the Hardin-Wyandotte company is to be started at once.

The Series Manufacturing and Sales Company, Canton, Ohio, has been organized with $18,000 capital to engage in the manufacture and sale of a newly patented leather fastener. Incorporators, A. H. Schaub, A. Dysle, F. E. Magee, A. L. Ricker, etc.

The Twin City Traction Company, of Columbus, Ohio, has been incorporated with a capital of $100,000 to build and operate a line between Dennison and Uhrichsville, Ohio. Incorporators, R. E. Westfall, M. M. Hoffman, Smith W. Bennett, etc.

The Fennia Manufacturing Company, makers of practical and useful novelties, such as dial levels, safety envelopes, folding umbrellas, paper-hanging machines, etc., of 52 West Sixty-Fifth street, New York, will erect a factory at Lincolndale, N. Y., in the near future.

The Central Ohio Power Company is being formed with a capital of $7,000,000 and will erect a power plant at Beaumont, O., for which C. W. Humphreys, of Chicago, has prepared plans. Headquarters will be Columbus. The concern is financed by the British Electric Traction Company, of London.

The Central Hudson Gas and Electric Company, a consolidation of the Poughkeepsie Light, Heat and Power Company, Newburgh Light, Heat and Power Company and the Hudson Counties Gas and Electric Company, has asked the Public Service Commission for permission to issue $600,000 in bonds for improvements and extensions.

SOUTHERN STATES

Fire destroyed the plant of the New Jersey Crate and Hamper Company, at Lanexa, Va.

The Stewart Vehicle Company, Martinsburg, W. Va., is erecting an addition to its plant.

It is reported that the plant of the Maryville (Tenn.) Hosiery Mills, recently burned, will be rebuilt.

American Ramie Comapny, New Hartford, Conn., manufacturers of fiber goods, will move its factory to Franklinville, Md.

The plant of the Virginia Manufacturing Company, Suffolk, Va., was destroyed by fire. Loss, $100,000. The company manufactured crates, barrels, butter plates, etc. The plant will be rebuilt.

WEST OF THE MISSISSIPPI

The Boone (Iowa) Electric Company will enlarge its plant.

The ice plant of L. D. Bruner, Grandfield, Okla., was destroyed by fire.

The Duluth (Minn.) Show Case Company will erect a plant to cost $40,000.

The city of Lyle, Wash., plans for the installation of a waterworks system.

E. E. Miller, Upland, Cal., will build a new fruit-canning plant near Ontario, Cal.

The Pemberton (Minn.) Creamery Association has let contract for a new plant.

The West Union (Iowa) Cement Company is planning the erection of a factory.

Robert Klug will build a plant to manufacture artificial stone, at Norfolk, Neb.

Bonds for $39,500 have been voted at Culbertson, Mont., for a waterworks system.

The Consumers Power Company, of Minot, N. D., will spend $100,000 in improvements.

The Wynoche shingle mill, at Montesano, Wash., was destroyed by fire. Loss, $25,000.

The furniture factory of Frank Ketchum Company, Portland, Ore., was destroyed by fire.

W. D. Murry, Deming, N. M., plans to build a number of new pumping plants in this district.

Bonds for the construction of a waterworks system at Arthur, Iowa, have been voted.

The Burt creamery, at Mason City, Iowa, was damaged by fire. Loss, $7000. Will be rebuilt.

The city of Mt. Pleasant, Utah, is planning for the erection of a municipal light and power plant.

The planing mill of the Chambers Lumber Company, Latham, Ore., was partially destroyed by fire.

A. P. Ritchie, of Bemidji, Minn., is secretary and treasurer of a concern which will build a creamery.

Bonds for $16,000 have been voted at Louisville, Neb., for the installation of a waterworks system.

The city of Dinuba, Cal., is planning to provide a bond issue for the installation of a modern sewer system.

The engine house of the Smoky Hollow Coal Company, at Oskaloosa, Iowa, was burned. Loss, $20,000.

The Mayville (Ore.) Investment Company is planning to install a new waterworks system in the near future.

The Galveston-Houston Railroad is planning for the erection of a new pumping plant near Langtry, Tex.

The city of Lindsay, Cal., will vote on a bond issue of $75,000 for the installation of a municipal sewer system.

J. C. Claussen, of Clinton, Iowa, has let the contract to Edward Kreeger for the building of a cold-storage plant.

The Rogue River Electric Company, Medford, Ore., is planning to install a lighting plant at Klamath Falls, Ore.

The city of Conconully, Wash., is planning for the erection of a municipal light plant and waterworks system.

The refining plant of the California-Fresno Oil Refining Company, Fresno, Cal., was destroyed by fire. Loss, $40,000.

The power plant of the Shawnee Gas and Electric Company, Shawnee, Okla., was destroyed by fire. Loss, $150,000.

The Northern Idaho & Montana Power Company will install pressure pumps in its power plant, at Kalispel, Mont.

The North Idaho Telephone Company, Wallace, Idaho, plans to install a new system between Murray and Nelson.

The San Joaquin Light and Power Company, Fresno, Cal., is planning to build a new substation at Los Banos, Cal.

The Pacific Coast Planing Mill Company, Los Angeles, Cal., has taken out a permit to build an addition to its plant.

The plant of the German Dye Works, Riverside, Cal., was partially destroyed by fire. All machinery was damaged.

The Pacific Lumber Company, Wilmington (Los Angeles), Cal., has taken out a permit to build an addition to its plant.

The plant of the Ajax Waste Mills, Dallas, Tex., manufacturing waste, was totally destroyed by fire. Loss about $30,000.

V. S. Cheyney, Willard, N. M., contemplates the installation of a new pumping plant. Gasolene engines will be used.

The Central Planing Mill Company, Salt Lake City, Utah, is erecting an additional mill at Third, West and Second, North.

The Rock Springs Exploration Company, Contact, Nev., plans for the erection of a new power plant on the Salmon river.

The Amador Electric Light and Power Company, Sutter creek, Cal., is planning to build a new substation at Jackson, Cal.

It has been voted to purchase or build a waterworks plant at Des Moines, Iowa. The value of the plant is fixed at $2,700,000.

C. F. Waters, Spray, Ore., is planning for the erection of a canning plant for alfalfa roots. Modern equipment will be installed.

The Booth-Kelley Company, Wendling, Ore., is planning to build a new refrigerating plant. Modern machinery will be installed.

The Western Asphalt Paving Company, Spokane, Wash., will build a new asphalt plant. Modern equipment will be installed.

The Columbia Box and Veneer Company, of Puyallup, Wash., will erect buildings, etc., blacksmith shop, machine house, dry kiln, etc.

A. R. McAfee, Topeka, Kan., is planning for the erection of a large woolen mill at Centralia, Wash. Modern equipment will be installed.

T. C. Wand, Seattle, Wash., contemplates the erection of an ice and cold-storage plant at Snohomish, Wash. Modern equipment will be required.

The city of Huntington Park, Cal., is planning for a bond issue for the erection of a municipal electric-lighting plant and a waterworks system.

George Ballantyne, Tacoma, Wash., will build a wood-working plant for the manufacture of fruit boxes. Modern machinery will be installed.

F. E. Isbell, proprietor of the Isbell Optical Company, of Clinton, Iowa, will erect a modern two-story factory; latest modern machinery to be installed.

Power-plant equipment will be required in the new apartment house to be erected by Henry Loewenthal, Los Angeles, Cal. Estimated cost, $255,000.

The Riverside (Cal.) Water Company is planning for a bond issue of $750,000, to be used for improvements and enlargements in its waterworks plant.

Power-plant equipment will be required in the new eight-story hotel contemplated by the Amos Brown Estate, Seattle, Wash. Estimated cost, $200,000.

The Warren Laundry Company, Bisbee, Ariz., recently incorporated, is planning for the erection of a laundry plant. V. M. Johnson is interested.

The Tobacco Valley Telephone Company, Eureka, Mont., is planning to install a new plant in this district. P. N. Benard is president of this company.

W. J. Orr, Anaheim, Cal., is planning for the erection of a plant for the manufacture of a patented concrete pole. Modern equipment will be installed.

J. P. Newell, Portland, Ore., is at the head of a company which is planning for the installation of a power plant on the Hood river, near Dee, Ore.

F. S. Pearson, Galveston, Tex., is at the head of a company which will build a number of electric-pumping plants on the Medina river, near San Antonio, Tex.

The Bakersfield (Cal.) Ice Delivery Company, now planning for the erection of a cold-storage plant at Taft, will later build a similar plant at Maricopa, Cal.

The Arizona Land and Irrigation Company, Prescott, Ariz., is planning to install a large irrigation system in this vicinity. About $1,500,000 will be expended.

Albert E. Wright, Portland, Ore., has been granted a gas franchise at Albany, Ore. A bond has been posted to insure the erection of a plant in the immediate future.

The power plant of the Phoenix (Ariz.)-Glendale Interurban Electric Company, at Orangewood, Ariz., was destroyed by a cyclone. The plant will be rebuilt.

The Colima Lumber Company, Colima, Colima State, Mex., will build a large lumber-mill plant for hardwood specialties. H. S. Dewey is interested in this company.

E. C. Wittman, Phoenix, Ariz., is planning for the installation of a power plant and electric-pumping irrigation system on the Hassayampa river, near Wickenburg, Ariz.

J. C. Dobbins (Glendale Sugar Company), Phoenix, Ariz., is at the head of a company which is planning for the erection of a power plant on the Gila river, near Dome.

The International Fisheries Company (Aurelio Sandoval, president), Los Angeles, Cal., is planning for the erection of lobster-canning plants on Cedros island, in Mexico.

The Kennewick (Wash.) Creamery Company has been incorporated and is planning for the erection of a modern creamery plant. W. F. Blaisdell is interested in this company.

Strong & Dickinson, Los Angeles, Cal., have acquired the Idyllwild district in the San Jacinto mountains. The company will install a water system, laundry and ice plant.

The La Paz Placer Gold Mining Company, near Ehrenburg, Ariz., plans to install a water system for mines operation. Pumping plants will be installed on the Colorado river.

The Worker Publishing and Printing Company, Bisbee, Ariz., has been incorporated, and plans for the erection of a printing plant. W. E. Stoner is head of this company.

The California China Products Company, National City, Cal., will build a large plant for the manufacture of china and tile from clay deposits. Modern machinery will be installed.

The Nevada Power and Transportation Company, Reno, Nev., is planning for the erection of a new power plant on the Truckee river. About 4000 horsepower will be the initial capacity.

Power-plant equipment will be required for the new eight-story building to be erected by Frank H. Short, Fresno, Cal. Estimated cost, $250,000. E. Matheson, architect, Fresno, is preparing plans.

The Laguna Gas and Oil Company, Elsinore, Cal., has been granted a franchise for furnishing gas for light, heat and power. The company will install a plant, using natural gas if conditions warrant.

A. W. Savage, Monrovia, Cal., is at the head of a company which will build a plant for the manufacture of a patented automobile tire. The organization is capitalized at $1,000,000, and will fully equip its proposed plant.

The Columbia Box and Veneer Company, Puyallup, Wash., will build a plant for the manufacture of boxes and veneer work. Modern machinery will be installed. A new machine shop and blacksmith shop will be erected.

Power-plant, cold-storage and vacuum-cleaning equipments will be installed in the new six-story apartment house to be erected at San Francisco, Cal. Estimated cost, $500,000. William Beasley, architect, San Francisco.

The Washington-Oregon Corporation, Vancouver, Wash., has acquired the property of the Tenino (Wash.) Light and Power Company. Extensive improvements will be made, and a new power plant built on the Skookumchuck river.

F. A. Worthley, Riverside, Cal., is at the head of a new power company which is planning for the erection of power plants in Inyo and San Bernardino countries. Construction for plants and systems estimated at $15,000,000.

The Cerritos Sugar Company, Los Angeles, Cal., recently incorporated, will build a new sugar factory at Clearwater, near Anaheim, Cal. Modern machinery will be installed throughout. H. S. Hadsell will be manager of the plant.

The Chicago-Rogue River Irrigation and Power Company, now installing an irrigation system near Grants Pass, Ore., will purchase new 12,000-gallon capacity pumping machinery in the near future. G. E. Sanders, Chicago, Ill., is head of this company.

CANADA

Thorold, Ont., will install a new sewage system.

Cowansville, Quebec, will install a complete new sewage system.

Edmonton, Alberta, will equip a new $100,000 hydroelectric station.

North Battleford, Sask., will equip a new waterworks pumping plant.

Hamilton, Ont., will spend $500,000 on a new municipal power plant.

A big new waterworks pumping station will be equipped at Toronto.

Olds, Alberta, will install a complete new waterworks pumping system.

Vancouver, B. C., will buy a large quantity of excavating machinery.

McLeod, Alberta, will install a complete new pumping plant.

[illegible] will buy new dynamos and equipment for electric-lighting plant.

McLeod, Alberta, will make important extensions to its electric-lighting plant.

Blyth, Ont., will equip an electrically operated pump for fire-fighting purposes.

Lethbridge, Alberta, will spend $120,000 in connection with a new sewage system.

Lethbridge, Alberta, will build a large new power house for a new street-railway system.

T. S. Simm & Co. will double their big brush-manufacturing plant at St. John, N. B.

The Fraser Valley Tile and Cement Company will build a very large new plant at Sapperton, Ont.

Edmonton, Alberta, will buy two new 6,000,000 waterworks pumps and complete equipment for same.

Hamilton, Ont., will spend $1,000,000 for waterworks purposes and will buy large quantities of new machinery.

Engineer George Taylor, of Wetaskiwin, Alberta, will purchase a large quantity of new machinery for a power plant.

New Glasgow, N. S., will spend $200,000 for waterworks extensions, including new pump house and complete new equipment.

The Taylor Manufacturing Company, of Princeton, Ind., will locate a big new factory in Hamilton, Ont., for the manufacture of store fixtures.

MINING

The Oro Plata mine, near Kingman, Ariz., will install a new stamp mill.

The Alpine mine, Plymouth, Cal., is planning to install a 20-stamp mill.

The Barker (Mont.) Mines Company will build a new concentrating plant.

The Yellow Tiger mine, Goldfield, Nev., will install new operating machinery.

The Graessell Zinc Plant, Park City, Utah, will install new machinery and electrify its plant.

The Plainview mines, near Unionville, Nev., will build a stamp mill in the near future.

The Mineral Creek mine, near Valdez, Alaska, will install a stamp mill in the near future.

The Black Oak mine, near Soulsbyville, Cal., will install new cyanide equipment at its mill.

The Mendha-Nevada mine, Pioche, Nev., is planning for the erection of a 50-ton milling plant.

The Hidden Treasure Mining Company, Bellevue, Idaho, will build a new concentrating plant.

The Boulder Consolidated Mining Company, Ketchum, Idaho, plans for the erection of a stamp mill.

The Copper Creek Mining Company, near Phoenix, Ariz., contemplates the erection of a smelting plant.

The Windfall Mining Company, Eureka, Nev., contemplates increasing the capacity of its milling plant.

The Wilson mine, Pine Grove district, near Yerington, Nev., is planning for the erection of a 10-stamp mill.

J. D. Meenach, operating on Bear creek, near Hope, Alaska, is planning for the erection of a stamp mill.

The West Coast Smelting and Refining Company, operating at Carbo, Sonora, Mex., will build a new milling plant.

The Hemple Copper Mining Company, Landlock Bay, near Valdez, Alaska, contemplates the erection of a concentrating plant.

The Lake Superior & Nevada Mining Company, operating in the Bradshaw mountains, near Prescott, Ariz., will build a new reduction plant.

The Holt Gold Amalgamating Company, Los Angeles, Cal., contemplates the erection of a new stamp mill at its property near Nogales, Ariz.

The Pearson Brothers, operating at Dos Cabezas, near Casas Grandes, Sonora, contemplate the erection of a large milling plant in the near future.

The Barytes Company of America, operating near Blair, Nev., is planning to install a crushing and concentrating plant of 100 tons capacity for barytes deposits.

Business Items

The Triumph Electric Company, Cincinnati, Ohio, reports that the past month has been one of the most prosperous in its history. It has orders in hand for about 200 motors of various sizes.

The Davis-Bournonville Acetylene Development Company and the National Pneumatic Company have appointed the Davis-Bournonville Company their exclusive selling agent for welding and cutting apparatus, and have added largely to its working capital and executive ability. The business of the Davis-Bournonville Company will be divided into the eastern department, with offices in its present quarters, 90 West street, New York City, and the western department with offices at 515 Laflin street, Chicago, the present quarters of the Chicago welding department of the National Pneumatic Company.

Trade Catalogs

The Stvanek Tool Company, Bridgeport, Conn. Catalog. Automatic bevel gear chuck. Illustrated, 6 pages, 3½x6 inches.

Union Twist Drill Company, Athol, Mass. Catalog No. 100. Milling and high power cutters, high-speed steel. Illustrated, 22 pages, 6x9 inches.

New Britain Machine Company, New Britain, Conn. Circular. "New Britain-Prentice" multiple-spindle automatic turret machines. Illustrated.

The American Tool Works, Company, Cincinnati, Ohio. Efficiency Bulletin. Facts for the superintendent, foreman, machine operator. Illustrated, 28 pages, 8½x11 inches.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Automatic and light machinery, tools, dies, jigs and fixtures designed. B. Nash, 257 Martense St., Brooklyn, N. Y.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Autogenous welding of broken cylinders and crank cases is most expertly done by Waterbury Welding Works, Waterbury, Conn.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Working drawings made from sketches or specifications; detailing and designing done; sheet metal layouts made; rates reasonable. Box 26, American Machinist.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

1000-horsepower engine wanted, to run 125 revolutions per minute, 125 pounds pressure, second hand, in first-class condition. Advise with full particulars at Room 1270, 50 Church St., New York.

Wanted, by a manufacturer's agent covering Pacific Coast, machinery, specialties, or supplies on commission basis; can furnish best of references. J. T. S., 409 Pacific Bldg., Seattle, Washington.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Large concern manufacturing an extensive line of conveyers, would like to make selling arrangements with agents on commission basis for all parts of the States. Address Box 39, American Machinist, 122 S. Michigan Blvd., Chicago.

Patents—An able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Auto cases and tubes first quality guaranteed—28x3 $10.30, tube $2.75; 30x3 $11.30, tube $2.85; 30x3½ $15.45, tube $3.75; 32x3½ $18.70, tube $4.25; 34x4 $27.45, tube $5.75. Send for list of all sizes. I ship, allow examination on receipt of 10 per cent. amount of order. The largest tire dealer in the central States. W. Vanderpool, Springfield, O.

A large and well known firm in central New England, which has been engaged in the manufacture of special machinery for upwards of forty years, is desirous of taking on some outside lines, its own legitimate line of manufacture being suffering from a depression in business, and in order to keep as many of its employees busy, and its organization as intact as possible during the dull period, we wish to make connections for taking on outside lines of machine work; our plant is a very complete and modern one; our machine tool equipment represents an investment of about $125,000; we have a full line of gear cutters, automatic screw machines, and Jones & Lamson turret lathes, etc.; our capital is ample, and we guarantee to handle in a satisfactory manner any work that may be intrusted to us. Write us your requirements. Address Box 72, Worcester, Mass.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Experienced hydraulic engineer to take charge of sales of water wheel installations; state experience. Apply to William Hamilton Company, Ltd., Peterborough, Ont.

Wanted—Mechanical partner with eight to ten thousand dollars capital in growing business in Canada; no encumbrance; must possess thorough knowledge of jig designing; to produce small interchangeable parts requiring rapid and accurate assembling; also gear cutting and building of marine motors. Address P. O. Box No. 682, Montreal, Canada.

CONNECTICUT

Wanted—A general foreman in a manufacturing plant located in the East; business of manufacturing small interchangeable parts in large quantities, now employing 125 men, but rapidly growing; man with experience in operating piece work system preferred; in making application state experience fully and give one or more former employers that may be referred to. Box 37, American Machinist.

DELAWARE

Wanted—First class operator for Jones & Lamson turret lathe. Modern Machinery Co., Wilmington, Del.

ILLINOIS

Wanted—First-class machinist and toolmaker to take charge of tool room and machine repairs in machine shop employing about one hundred and fifty men; no jig designing required, but must be energetic, systematic and capable of handling eight to ten men efficiently. Address "Gas Engines," American Machinist.

Mechanical engineer and designer, with theoretical education and long successful mechanical and practical experience on automatic machinery, quick and conscientious work on the board, capable of systematizing and taking charge of designing office and of developing ideas; steady position for the right man with chance for advancement; only first class men need apply; state age, experience, reference and salary expected. Box 38, American Machinist, 122 South Michigan Blvd., Chicago, Ill.

IOWA

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, Am. Ma.

MARYLAND

Wanted—Capable mechanical draftsman with five years' actual experience, especially marine engines; give character of experience and salary desired. Ellicott Machine Company, Baltimore, Md.

MASSACHUSETTS

Wanted—First class die and toolmakers; also a few general mechanics; applicants will please give references and experience for the past three years. Box 55, Amer. Machinist.

Wanted—First class car draftsmen, those familiar with wood and steel car experience preferred; none but first class men need apply. Osgood Bradley Car Company, Worcester, Mass.

Mechanical Engineer—A rapidly growing business in Massachusetts needs an engineer, technical graduate preferred, who has had experience in developing and manufacturing light automatic machines; he should have business experience connected with selling or installing machines, in order to assist the general manager. Box 41, Amer. Machinist.

Wanted—General superintendent for a large and successful manufacturing concern employing high grade skilled labor; applicant must be man of first class mechanical ability and familiar with modern production methods, having a large and successful experience in handling help; he must also be capable of organizing various mechanical departments and be proficient in obtaining the fullest efficiency of same. Box 17, AMER. MACH.

MISSOURI

Wanted—"Cracker Jack" mechanical draftsman, one with technical education preferred, who can advance to position of chief draftsman; must be rapid and accurate and of good personal appearance; give age, experience, education and salary expected. Box 57, AM. M.

NEW JERSEY

Wanted—First class meter designer for large manufacturing establishment; permanent position for competent man. Box 49, AMERICAN MACHINIST.

Wanted—First class toolmakers; also some first-class all-around machinists; steady employment with good wages for efficient men. Box 924, AMERICAN MACHINIST.

First class tool designers wanted. Apply Crocker-Wheeler Company, Ampere, N. J., stating age, experience and salary expected.

Draftsmen—Competent men with broad experience in mill building construction, power plant design and general engineering wanted at once by large industrial plant near New York City; full particulars as to experience, age, salary and references wanted. Box 991, AMERICAN MACHINIST.

NEW YORK

Wanted at once, experienced toolmakers familiar with jig and die work. Standard Typewriter Company, Groton, N. Y.

Wanted—First class machinists, familiar with marine work, tool hands and outside men only; good wages. Box 3, AM. MACH.

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 984, AMERICAN MACHINIST.

Wanted—First class machinists; must have best of references and give full particulars in regard to previous employment. Box 44, AMERICAN MACHINIST.

Wanted—Two first class operators of horizontal boring machines; state age, experience and references; applications considered confidential. Box 23, AMERICAN MACHINIST.

Foreman for machine shop, experienced in modern methods and in building internal combustion engines; give references, salary and experience last five years; northern New York. Box 34, AMERICAN MACHINIST.

Wanted—Draftsman, experienced in valves or pumps preferred; in replying, state experience in detail, age, wages expected, if now employed, married or single; permanent position for right man. Box 11, AM. MACH.

Wanted—Machinists wanted. lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—First class tool and die makers, drop-forge die sinkers, Fox lathe hands; steady position, good wages, no labor trouble; apply by letter, giving detailed account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—Works manager for factory employing two hundred machinists and molders; must have technical education, shop practice and proved executive ability; state terms, experience and reference; location, central New York. "R. F. S.," AMERICAN MACHINIST.

Salesman for line of pliers and some high grade specialties to visit jobbing and retail trade east and west; must also visit machine shops to introduce specialties; state age, experience, territory covered, salary desired and references. "K. F.," AMERICAN MACHINIST.

Wanted—First class machinists, erectors, toolmakers, die sinkers, lathe, planer, screw machine, boring, milling and gear cutting machine hands, Jones & Lamson, Gisholt operators and Norton grinders; clean, uptodate shop; steady position. Apply, giving account of past experience, names of previous employers and wages expected, to R. Hoe & Co., 504 Grand street, New York.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

OHIO

Wanted—For Chicago territory an experienced crane salesman; man with mechanical engineering experience preferred. Box 30, AMERICAN MACHINIST.

Wanted—An office manager with practical experience in mechanical lines and is able to invest $5000 for ¼ interest, in manufacturing a machine that has no competition and is an immense seller. Box 35, AMERICAN MACHINIST.

General superintendent for machine shop employing 400 men; must be conversant with modern shop practice, system and cost accounting, strictly high grade; state age, experience and full details first letter. Box 52, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Practical machinist, experienced in rate setting and time study work; must be familiar with steam engine or pump work. Box 48, AMERICAN MACHINIST.

Machinists Wanted—First class lathe, planer, boring mill and bench hands. Address Mr. Wm. J. Casey, Shop Superintendent, The Jeanesville Iron Works Co., Hazleton, Pa.

Wanted — One quarterman shipfitter-in-charge at $5.04 per diem; a competitive examination will be held July 17, 1911, for the purpose of filling the above position. For further information address "Commandant, Navy Yard, Philadelphia, Pa."

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—50 tool makers; experienced men on jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter, stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

WISCONSIN

Wanted—Assistant foreman; a practical tool and die maker; we want an intelligent man possessing executive ability and able to lay out tools for cutting and drawing light sheet metals; a man with experience at making cooking utensil tools preferred; state age, salary wanted and where you have been employed. Address Supt., 880 Downer Ave., Milwaukee, Wis.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Draftsman and designer, mechanical, with varied experience on general and special machinery, desires to locate in or near New York City; technical graduate; best of references. Box 45, AMERICAN MACHINIST.

Mechanical and electrical engineer, nine years' experience, holding A-1 position with large company, manufacturing elevators, wants similar position or as technical advisor of insurance interests in New England; capable of taking charge. Box 53, AMER. MACHINIST.

ILLINOIS

Position as superintendent, by expert tool designing draftsman, experienced as draftsman, tool and die maker, and tool room foreman on typewriter and similar work; age 32, married. Box 6, AMERICAN MACHINIST.

INDIANA

A-1 mechanic; age 33; 14 years' experience as all-around machinist, toolmaker and foreman; technical knowledge; familiar with uptodate methods and capable of designing special tools and jigs; now employed with firm manufacturing gasolene motors; good reason for changing; correspondence confidential. Box 60, AMERICAN MACHINIST.

MAINE

Manager or superintendent of machine shop, forge or foundry; first class references. Box 996, AMERICAN MACHINIST.

MASSACHUSETTS

Master mechanic with broad experience in factory and machine shop; construction of special machinery tools, dies, patterns, electro plating and fiber manufacturing; engaged; would correspond; location immaterial. "M. M. S. R.," AMERICAN MACHINIST.

NEW JERSEY

Mechanical engineer, with office and shop experience, desires position in Metropolitan district. Address "E.," Box 51, AMER. MACH.

First class wood patternmaker, at present employed, desires change; experienced on gasolene engine and experimental work; best of references. Box 59, AMERICAN MACHINIST.

NEW YORK

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Designer of crude-oil high-compression reversible engines, open for responsible position of design or construction. Box 999, AM. MA.

Working foreman, toolmaker and all-around machinist, 18 years' experience on machine tools, electrical, experimental and automatic. "W. H.," AMERICAN MACHINIST.

Mechanical superintendent, with 18 years' experience, wishes change; broad experience in factory management; a good executive and organizer; good references. Box 28, AM. MA.

Designing draftsman, technical graduate, general experience and 15 years with air compressor and Corliss engine builders, wants position; best of references, full particulars on request. Box 33, AMER. MACH.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Position wanted as manager or superintendent by man of large experience, where executive and inventive ability would be of value; good in making small articles in wood and metal. Box 46, AMERICAN MACHINIST.

Mechanical man, age 29, technically trained, 11 years' experience in shop and drawing room, at present assistant chief draftsman of large manufacturing concern, desires position as chief draftsman or mechanical engineer. Box 47, AMERICAN MACHINIST.

OHIO

Experienced (20 years) superintendent or master mechanic desires change; modern shop methods; executive and an organizer; good references. Box 58, AMERICAN MACHINIST.

Automobile engineer, with eight years' experience in drafting room, shop and experimental room, desires to make a change; recommendations exceptionally good. Box 27, AMERICAN MACHINIST.

PENNSYLVANIA

First class draftsman with eight years' experience, wants position. Box 8, AM. MACH.

Designer on special machinery, ready to develop ideas, desires change. Box 9, AM. M.

Cost accountant, broad gage, practical shop man, desires change. Box 42, AM. MA.

Competent draftsman, with three years' varied experience, would like a situation near New York; best of reference. Box 40, AM. M.

Draftsman, 30, technical, 11 years' experience, including four in shop, capable designer, special and automatic machinery, engines, etc., successful as executive, some tool work, now employed, but wishes change for good reasons. Box 54, AMERICAN MACHINIST.

Superintendent, specialist in uptodate production methods and cost reduction; over 19 years' active and practical experience in machine shop, engineering office, in plants making interchangeable machinery; married; 35 years; best of references. Box 56, AM. MA.

WISCONSIN

I am qualified to superintend the installation and operation of the efficiency or bonus system, having had several years' experience in that branch of manufacturing. Address "X Z," AMERICAN MACHINIST.

FOR SALE

Machine shop for sale in a manufacturing town in New Jersey; good chance for one or two bright mechanics to invest a few thousand dollars; an excellent opening for automobile shop along with present business. Box 43, AMERICAN MACHINIST.

For Sale—One ¾-inch new model Cleveland automatic screw machine with three spindle speed attachment, tilting magazine and complete set of tools; new machine in perfect condition; has been used not more than 700 hours; not adapted to our work. Box 956, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Vacation days are here—the time when some of us are wondering where to go, some if they can afford to go where they want to.

But did you ever stop to think how much we are dependent upon advertising for not alone our knowledge of time and labor-saving methods and machines, but for our pleasures?

Even the natural wonders of the world do not attract special attention unless they are properly advertised.

Read what Elbert Hubbard says about it in the *Philistine*: "Time was when the Mammoth Cave of Kentucky was one of the wonders of the world. The Cave is there yet, but only colored picnic parties go there now, or possibly an occasional person wanders thither because he remembers how, in days agone, his father and mother made their wedding journey here, and then came home and talked of it for the rest of their lives.

"Records can be seen at the Mammoth Cave hotel showing the exact number of persons who have visited the Cave since this hotel was opened in 1837.

"It is worth while to note that in the year 1844 an average of ninety-three persons a day were shown the wonders of the Mammoth Cave, while in 1905 the average, not counting local picnic parties, was less than a dozen. In 1844 the population of the United States was less than twenty millions, and there was not a railroad in the State of Kentucky. And yet people came here from all the New England and Middle States by the hundred.

"Edward Everett guided a party of New England school teachers here in the summer of 1847. They came by way of Pittsburg, taking a steamer thence to Owensboro, Ky., and then by stage a two days' ride—eighty miles—to the Cave.

"The hotel is here now practically as it was then, and one can easily believe that no new furniture has been added.

"From 1840 to 1870 scarcely a person of note then living but visited the Cave—it was a sort of finishing touch to one's education, and people who could not talk intelligently of Niagara Falls and the Mammoth Cave had no standing in polite society.

"Everett gave lectures at Harvard on the Mammoth Cave. Webster gave a great speech at the Cave in 1854, and Emerson, in his essays, several times refers to his visit here, telling of the fish that have no eyes to see.

"Barnum brought Jennie Lind here, and she sat in a stalagmite chair that is now proudly pointed out by the guides.

"From the year 1850 to the breaking out of the war in 1861, there were held over three hundred conventions of learned societies, college alumni, and gatherings of prominent people from all over the world.

"It is worth while to note the stern fact that even the wonders of creation do not actually attract any special attention unless some advertising man gets busy. The railroads really make Niagara Falls go. They are advertising it continually as a continuous performance, and filling people with a desire to go there, then transporting them for consideration."

* * *

Whether in search of pleasure or profit, it pays to read advertising.

Especially is this true of the real vital *news* of your business—the ideas and helpful suggestions in the Selling Section of the AMERICAN MACHINIST.

A careful reading of it each week will make you better fitted to think, talk and *act* on the most economical and effective means of doing your work.

* * *

Only reliable products can be continuously advertised.

Building Panama Canal Lock Gates

Editorial Correspondence

We are in the habit of thinking of the building of the Panama Canal as a job of digging—the moving of huge masses of earth and rock. Broadly speaking, this is true. But in the building of the gates for the locks and their operating machinery, there is a great deal of interesting machine-shop work. It is, therefore, a source of satisfaction to be able to present to the readers of the AMERICAN MACHINIST a series of photographs and drawings showing the mechanical details of these huge lock gates and some of the methods and tools used in their building.

The bids for these gates were opened on June 15, 1910, showing the successful bidder to be the McClintic-Marshall Construction Company, of Pittsburg, Penn. The sum of the bid was $5,374,474.82 for the entire work. This comprises 46 lock gates completely erected in place and spare parts sufficient for the construction of one additional gate of two leaves of the larger size. The accompanying table shows the hight of the gates and their location at Panama. The total amount of material covered by this contract is 118,488,100 pounds, or, roughly 60,000 tons.

Mechanical details of the bearings, hinges and water-tight meeting strips; and the general design. Machining operations in making and assembling the parts.

If all the gates were piled end to end, one on top of the other, they would make a tower more than a mile and a quarter high.

To show the immensity of the job in a striking way, were all of the gates to be piled end to end, one on top of the other, they would make a tower more than a mile and a quarter high.

In Fig. 1 are shown two sections, each one-fourth of the hight of a finished gate, of one 77-foot leaf. The part at the left is the lower third, and the part at the

FIG. 1. LOWER THIRD AND MIDDLE THIRD OF ONE LEAF OF A 77-FOOT PANAMA CANAL LOCK GATE

right the middle third. It has been the practice of the McClintic-Marshall Company to erect, as shown, one leaf for each hight of gate. At the time of this writing, a considerable portion of the work has been fabricated and shipped to Panama, where erecting is in progress.

The gates are what is known as the mitering type (See the lower part of Fig. 2).

General Description of the Design

Fig. 2 shows in elevation and a few sections the general design for one leaf of a 77-foot gate. It consists essentially of a system of horizontal girders, vertical end girders, and connecting frames, diaphragms and intercostals, forming a skeleton, covered on both sides with steel plate sheeting extending from the top to the bottom. The lower part for a distance roughly one-half of the hight is to be water-tight and will serve as an air chamber or flotation chamber for the leaf. Water is permitted to enter the upper part.

At both ends of each leaf is a vertical nickel-steel bearing strip secured to

Hights	Number of Leaves			
	Total	Gatun	Pedro Miguel	Miraflores
82 feet	4	..	..	4
79 feet	16	..	16	
77 feet	40	24	..	16
77 feet 10 inches	8	8	..	
66 feet	4	..	..	4
64 feet 8 inches	8	4	4	
47 feet 4 inches	12	4	4	4
Grand total	92	40	24	28

steel end reaction castings. The thrust of the water is transferred through the gate to the bearing strip at the masonry end, and to each leaf from its mate at their meeting point. On the bottom of the lock is bolted a timber sill acting as a stop. The top of each leaf has a concrete footwalk and suitable handrailings.

The method of support, also shown in Fig. 2, consists of a hemispherical pintle at the bottom of the masonry end of each leaf, and a hinge at the top. Each leaf is to be swung open and shut by means of a stiff strut operated by mechanism driven by an electric motor and located on the lock wall. Fig. 3 shows in assembly the pintle bearing. It consists of a heavy cast plate set in the masonry floor of the lock and supporting a vanadium-steel shoe, in which the nickel-steel pintle is set. This pintle is hemispherical in shape and has a diameter of 16 inches. The bearing with which it mates is of manganese bronze, set in a heavy vanadium-steel casting fastened to the lower girder of the leaf. The load upon each one of these bearings is enormous in spite of the flotation effect of the air chamber. This can be judged when the weight of the heaviest leaf is considered; namely, 1,483,700 pounds, or nearly 750 net tons.

At the top is a large hinge, shown in assembled detail in Fig. 3. The hinge pin is of nickel steel, ten inches in diameter and bears in a bronze bushing. This bushing is set in the outer end of a large yoke casting, which in turn is keyed to a steel structure embedded in the concrete side wall of the lock. Fig. 4 shows a detail of this yoke casting and of the flat-steel keys used to key it into place.

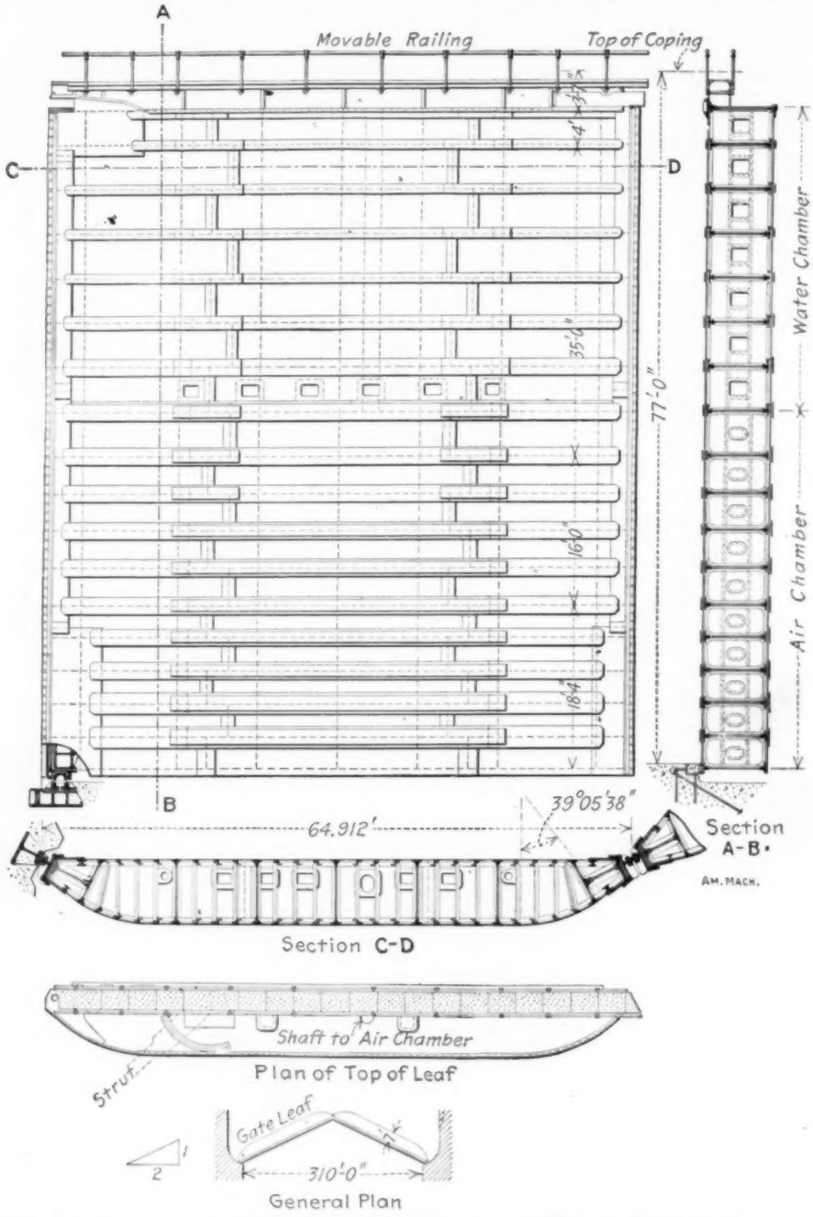


Fig. 2. Elevation and Sections of One Leaf of a 77-foot Panama Canal Lock Gate

Details of the Water-tight Joint

Fig. 5 shows details of the bearing strips at both the mitering end and masonry end of each leaf. These strips are of nickel steel with curved bearing faces that are expected to meet and form a practically water-tight joint. As a means of setting these strips truly vertical and having them fit for their entire length they are made to enter a machined groove in the large steel reaction castings on the end of each leaf—see *B* of Fig. 1—are provided with adjusting screws, and after they are finally set in position the space between their backs and the faces of castings is to be run with babbitt. These details are well shown by Fig. 5.

The final leveling of the shoe carrying the hemispherical pintle at the bottom of the leaf is likewise to be done by using babbitt. As a matter of interest, the specifications call for some 350 tons of babbitt to complete the entire job.

The nickel-steel specified for the pintles, hinge pins, bearing plates and wedges, as shown in Figs. 3, 4 and 5, shall contain not over 0.04 per cent. of phosphorus, nor 0.05 per cent. of sul-

phur, and not less than 3.25 per cent. of nickel. Its ultimate strength shall be not less than 85,000 nor more than 100,000 pounds per square inch, with a minimum yield point of 55 per cent. of the ultimate tensile strength and a minimum elongation in two inches of 1,750,000 divided by the ultimate tensile strength.

Workmanship Required

At first glance the building of these gates may be looked upon as merely a structural-steel job, like bridge building or fabricating and erecting the steel frame of a huge building. Such, however, is not the case. From the fact that these gates are moving members and that they must fit to make reasonably water-tight joints, a greater degree of accuracy is required than is called for by the ordinary bridge-building job. On the other hand, from the fact that the lower half of each gate must be water-tight to form the air chamber, puts part of the work of framing and sheeting in the class of shipbuilding rather than ordinary structural work. Thus we find a great deal of machine work being done in finishing the girders and frames for these gates; in fact a number of machine tools were installed especially for this job. To show still further the likeness to a shipbuilding job, there will be millions of feet of calking to make the air chambers water-tight and at some points, particularly the ends of the girders, sheets of canvas soaked in red lead paint are being inserted between the plates to act as water stops. Furthermore, each gate is divided by means of vertical bulk heads into six series of compartments. These compartments are connected by means of water-tight bulk heads, and one compartment is connected with the top of the leaf by a man shaft, thus permitting of inspection at any time.

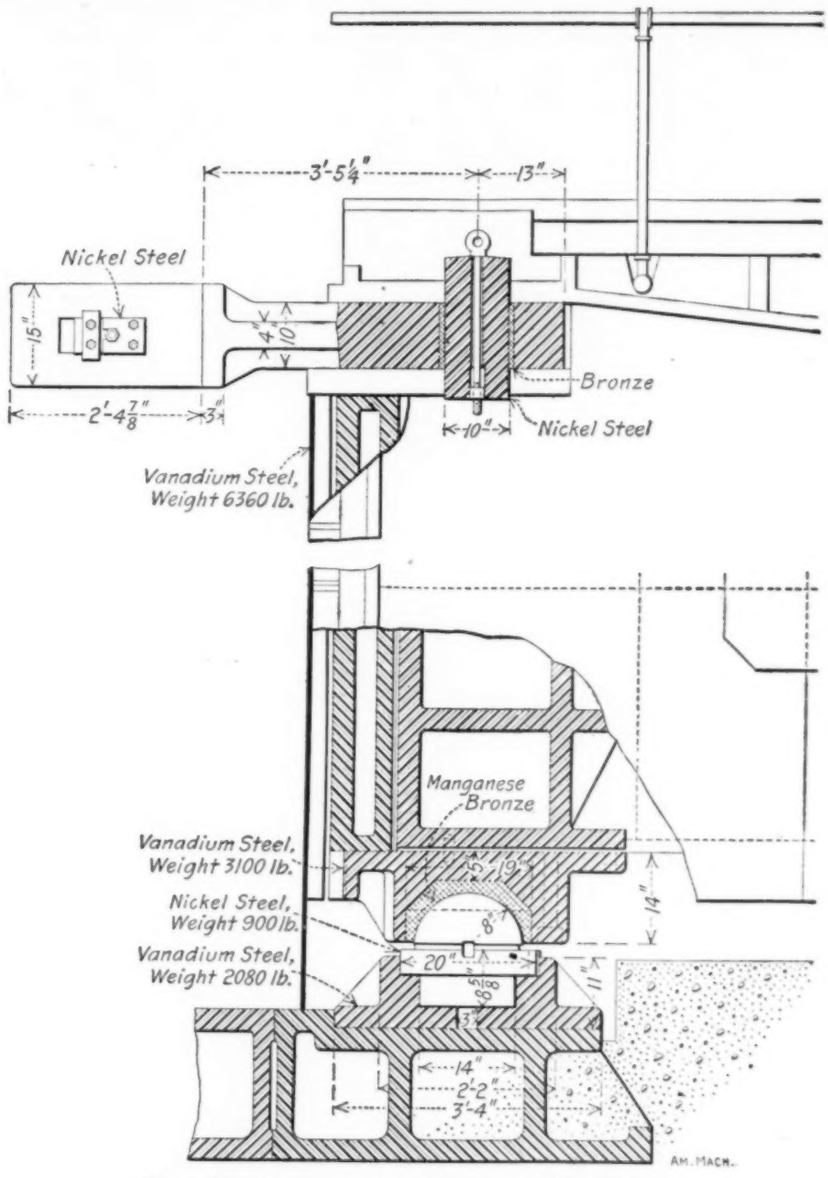


Fig. 3. Assembly of Pintle Bearing and Top Hinge

To remove any leakage which may enter the air chambers or to dewater in case a chamber should be flooded, a centrifugal pumping system is to be installed, the general scheme of which is shown in Fig. 6.

As further interesting mechanical details, the handrailings at the top of each leaf, see Fig. 3, are provided with mechanism whereby they can be collapsed and laid down against the sides. This is to permit a tow line to be carried across the top of the gates and dragged thereon.

A Few Provisions of the Specification

A few of the provisions of the specifications and contract dealing with the mechanical details are of interest. The contract is based on a pound price, namely 3.785 cents per pound for structural steel erected, and 2.62 cents per pound for structural steel not erected. All material after it is finished and ready either for shipment to Panama or for temporary erection at Pittsburg is carefully weighed by Government inspectors. If the final weight exceeds the computed weight by a percentage greater than the following factors, the excess is not to be paid for. Excess is permitted on castings to the amount of 5 per cent., on shapes, bars and other steel 2 per cent., on plates ranged from 3½ to 13 per cent., depending upon the thickness of the plate and its width.

From the necessity of preventing rusting as much as possible the specifications call for the removal of all rust and mill scale by sand blasting or by wire brushing for surfaces that are to be in contact after riveting, for the removal of all grease by means of gasolene or other fluid, and the applying of a first coat of paint immediately after the cleansing has been finished and before any oxidation has taken place. In order to hasten the work, pickling is also being used for parts that are not in any way assembled before shipping. At a later point in this article the sand-blasting and pickling plants are illustrated.

Two kinds of paint are specified, namely bitumastic solution, made by the American Bitumastic Enamel Company, of Philadelphia, and a pure red-lead paint. The composition of this latter is, pure red lead 35 pounds, raw linseed oil one gallon, spirits of turpentine two gills, Japan dryer two gills.

Again with the idea of durability in mind, the specifications call for the use of British Guiana green-heart timber for the sills against which the gates stop on the bottom of the lock and for the fenders on the sides of the gates against which a passing ship may rub.

All threads for all bolts throughout the entire work are to be United States Standard.

As a large number of patterns have been needed, it is specified that they shall become the property of the Isthmian Canal Commission after the work is finished; this, of course, with an eye to future repairs.

Shop Operations in Building the Gates

Fig. 7 to 23, inclusive, show a number of shop operations in making the parts shows one of these girders being drilled after partial assembling. The way in which the pieces are bolted together in order to assure alinement, and the use of jig castings as seen at the right-hand end, are shown in this figure. Great care has been taken to have the holes properly alined, in order to facilitate erection in the field. In fact, turning again to Fig. 1, the lining up of the holes in the outer sheeting and the inner girders on the

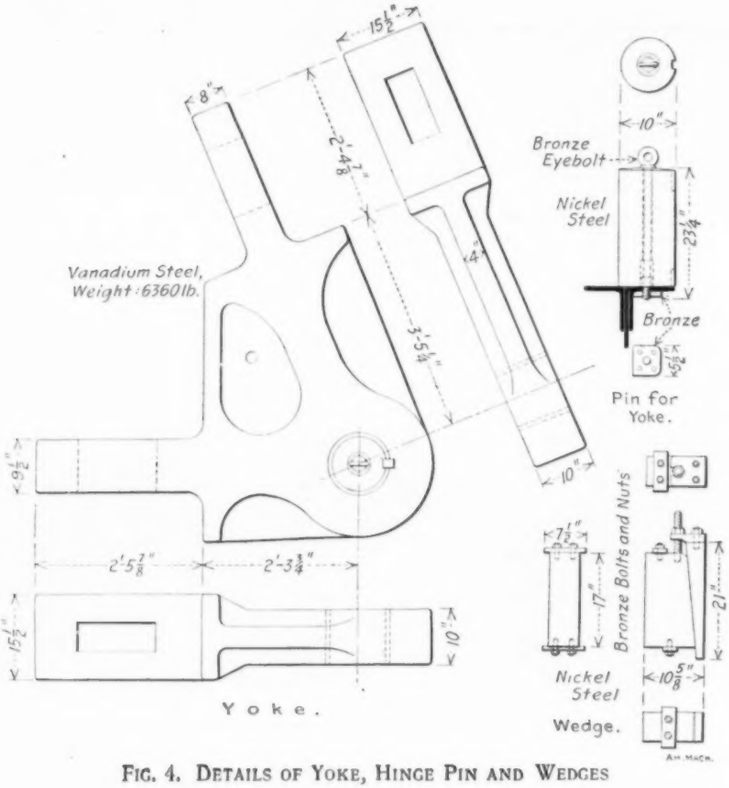


Fig. 4. Details of Yoke, Hinge Pin and Wedges

of the gates, and are representative of the work as it is now being carried on in Rankin, Penn. The largest assembled pieces are, of course, the horizontal girders, the largest members of the skeleton of each leaf. Fig. 7 shows such a girder after being riveted together, and on its way to the sand-blast house. Fig. 8 curved ends is something noteworthy. When the material for this article was collected a particular examination was made of these holes and the alinement was found to be of the best.

Fig. 9 shows another girder, not as much assembled as the one in Fig. 8, but undergoing the reaming and counter-sinking operations. This particular girder is for the top of one leaf, as shown by the circular plate with a large central hole, seen at the left-hand end. The use of numerous bolts to hold the parts assembled during the machining operation is well illustrated by this photograph.

Fig. 10 shows one of these girders in the operation of having its ends milled to length. Turning a moment to Fig. 5 it will be seen that the ends of the girders are not parallel, but stand at a considerable angle. In order to get these ends at the exact angle required and at the same time get the girders to the required length in order that there may be no difficulty in setting the vertical bearing plates in the field, it has been found best to mill these ends as shown. For that reason two vertical Newton millers were purchased and are seen in position for this operation in Fig. 10.

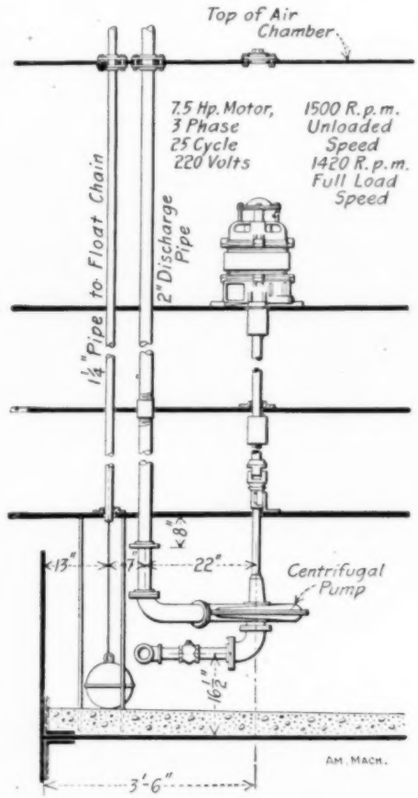

Top of Air Chamber
7.5 Hp. Motor, 3 Phase 25 Cycle 220 Volts
1500 R.p.m. Unloaded Speed 1420 R.p.m. Full Load Speed
1¼" Pipe to Float Chain
2" Discharge Pipe
Centrifugal Pump
Am. Mach.

Fig. 6. Pumping Plant for a Leaf

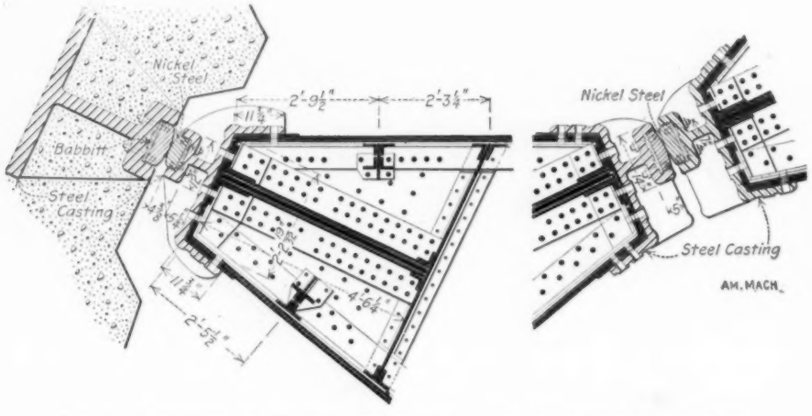


Fig. 5. Sections of Bearing Strips at Both Ends of a Gate Leaf

Turning now to Fig. 11 we see an unusual horizontal boring operation. This is the set-up for boring the hinge pin holes in one of the top girders. The illustration is so plain that description is unnecessary.

Figs. 12, 13 and 14 show three milling operations and give an idea of the amount of machine work that is necessary in making the parts. Fig. 13 shows the surfacing of all four sides of some of the inner frames. Fig. 12 shows the squaring up of sheeting plates and Fig. 14 shows the squaring off of the ends of one of the

bent plates forming the ends of the leaf and to which the steel castings are bolted, which later on are to receive the nickel-steel bearing strips.

In Fig. 15 we see a drilling operation and have illustrated the use of drilling templets, of which a large number have been made for the job. These templets are pieces of sheet steel in which hardened-steel bushings are driven.

Fig. 16 shows the bending of an angle for one of the girders. On top of the movable jaw of the bulldozer is a sheet-metal templet, to which the bend is fitted.

Figs. 17 and 18 show a power-driven punch with a strip-steel templet in place for locating punched holes. Fig. 18 shows in more detail a portion of the pilot wheel and the pawl moved along the strip or shape being punched and used for locating the holes. A large number of templets have been made for this work, a few of which are shown in the rack of Fig. 19. These are all of strip-steel painted white with scribed lines giving the spacings of the punched holes.

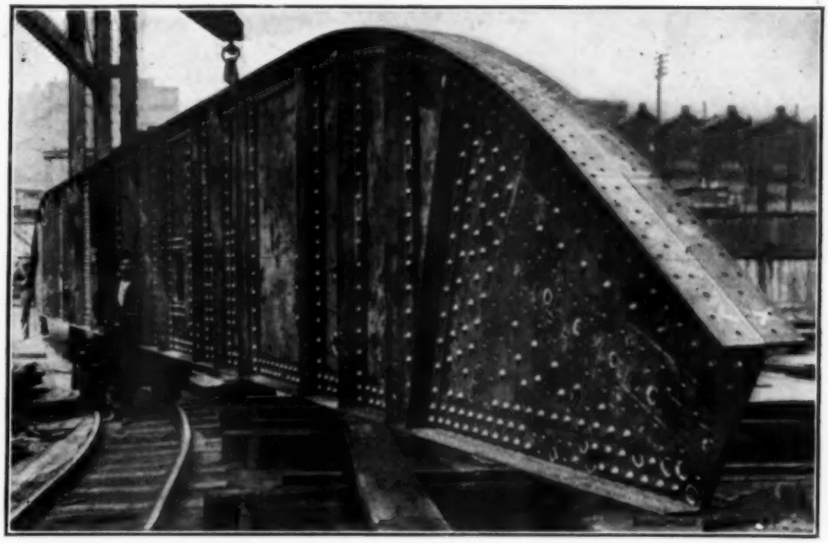


FIG. 7. A HORIZONTAL GIRDER ASSEMBLED AND ON ITS WAY TO THE SAND-BLAST HOUSE

A forging job is illustrated by Figs. 20 and 21. It is the making of an angle-iron, water-tight frame. Fig. 20 shows the forge and anvil block with an offset forged and the miter cut. In the fore-

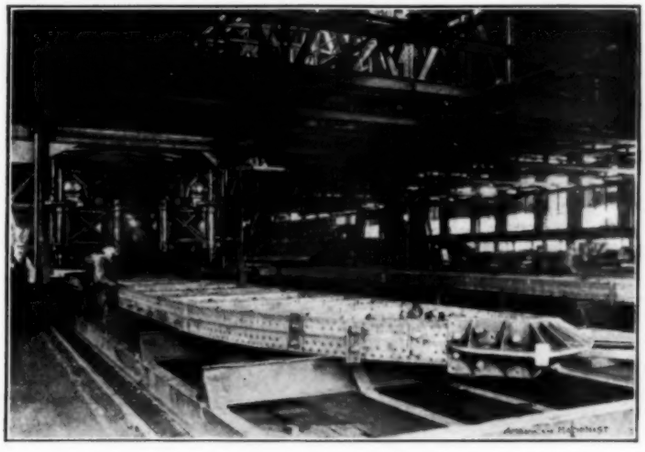


FIG. 8. DRILLING A LOCK-GATE LEAF GIRDER

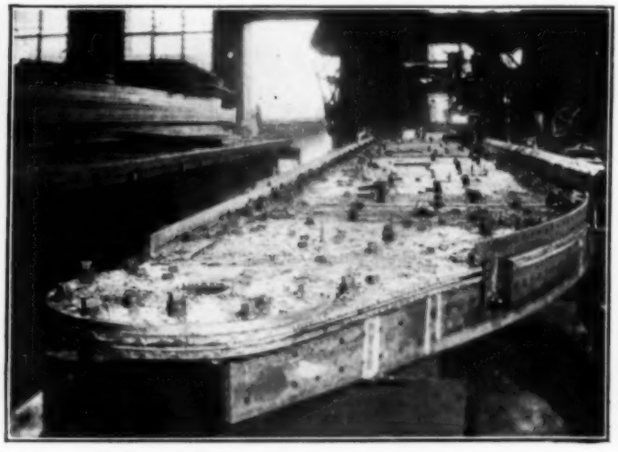


FIG. 9. REAMING A LOCK-GATE LEAF GIRDER

FIG. 10. MILLING THE ENDS OF A LEAF GIRDER

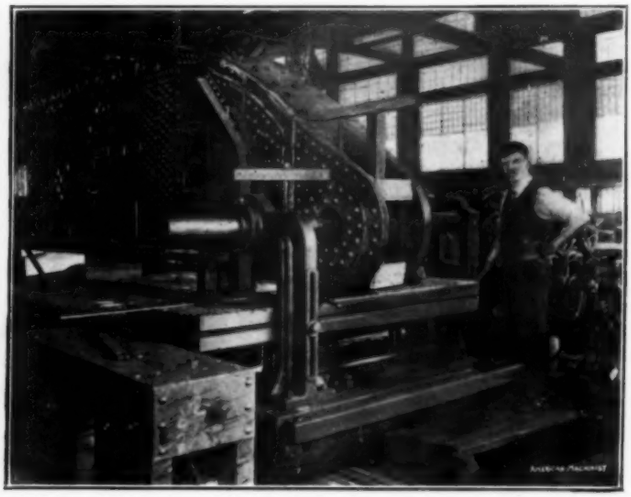


FIG. 11. BORING THE HINGE-PIN HOLE IN A LEAF GIRDER

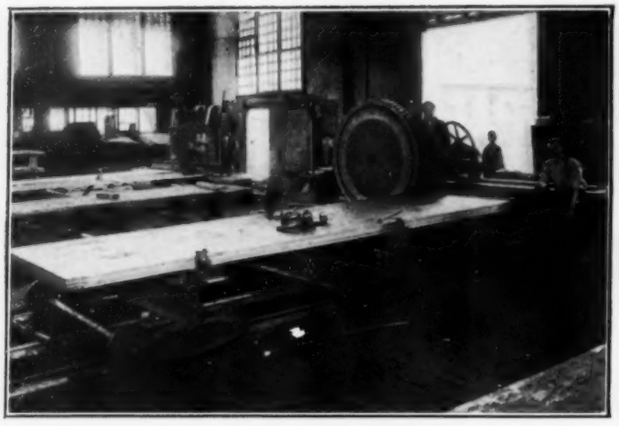


FIG. 12. SQUARING THE EDGES OF PLATES FOR OUTSIDE SHEETING

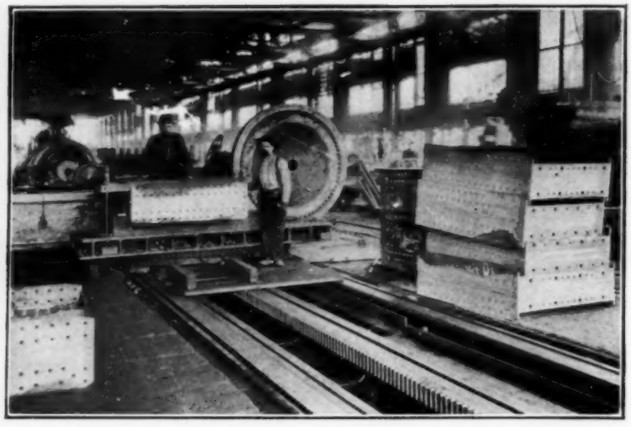


FIG. 13. ROTARY PLANING ALL FOUR SIDES OF INNER FRAMES

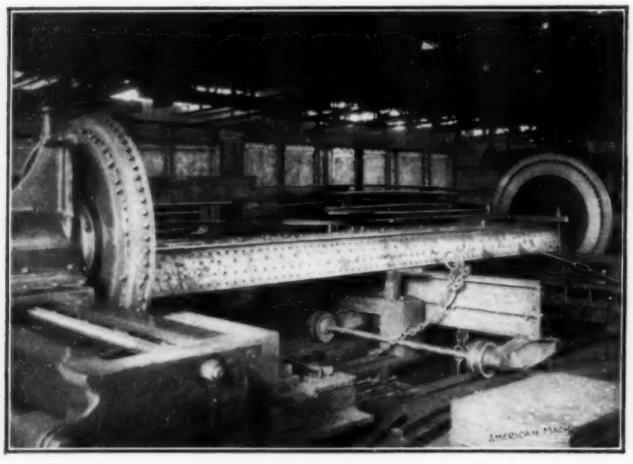


FIG. 14. SQUARING THE ENDS OF A BENT PLATE FOR THE END OF A LEAF

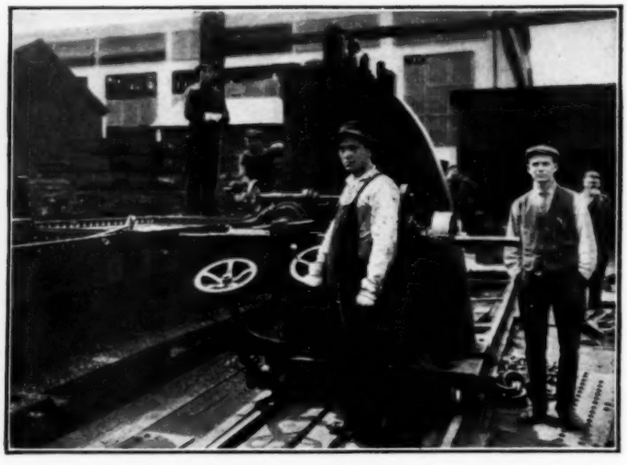


FIG. 15. DRILLING FRAMES, USING A DRILLING TEMPLET

ground is a steel templet to which the frames are fitted. Fig. 21 shows at the right a finished frame, at the left a frame offset and bent ready to weld, and on the horses at the back a length of angle iron from which the frame is made, and a length forged ready to bend. Several thousand of these frames are required, and as made they represent an excellent job of structural steel forging. The final illustrations show the apparatus used for cleaning the mill scale and rust from all of the parts prior to the first painting. Fig. 22 shows a girder inside of the sand-blasting house used to clean the surfaces of riveted members, which it would be inadvisable to pickle. The capacity of this plant as operated is some 48,000 square feet per week.

The smaller parts, such as are shipped to Panama without being riveted together, are being pickled in the tanks shown in Fig. 23. Here are three pickle tanks and two lime-water tanks. Sulphuric-acid pickle is used. The tanks are served by an overhead traveling crane and have a combined capacity of some 60,000 square feet of surface per week of 54 hours.

In closing it is a pleasure to acknowledge the courtesy of the Isthmian Canal Commission and the McClintic-Marshall Construction Company in providing facilities for procuring the photographs and material upon which this article is based.

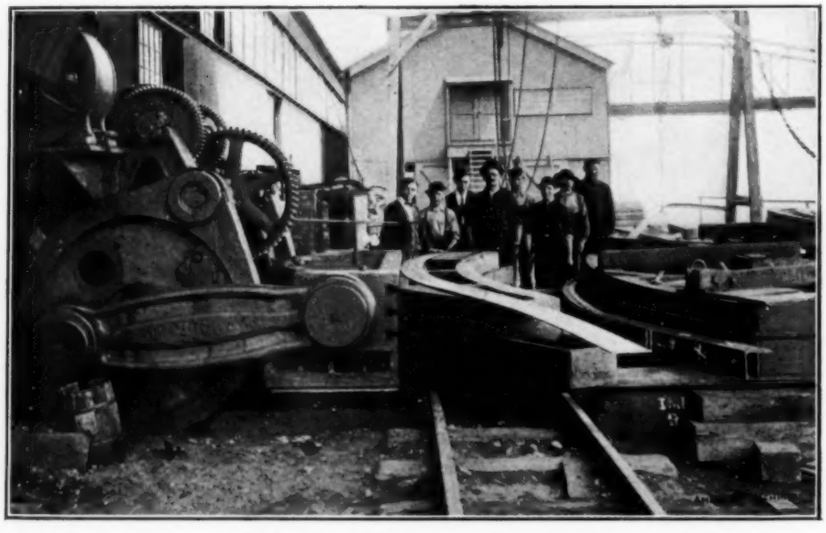


FIG. 16. BENDING THE LARGE ANGLES OF THE HORIZONTAL GIRDERS OF ONE OF THE LARGER GATE LEAVES

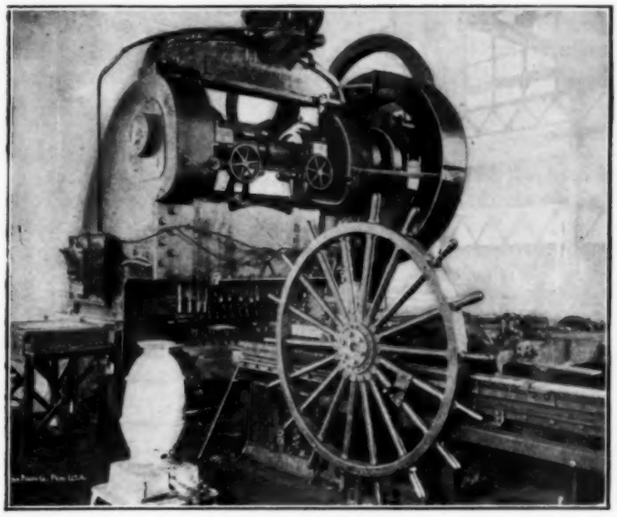


FIG. 17. POWER PUNCH USED FOR PUNCHING RIVET HOLES

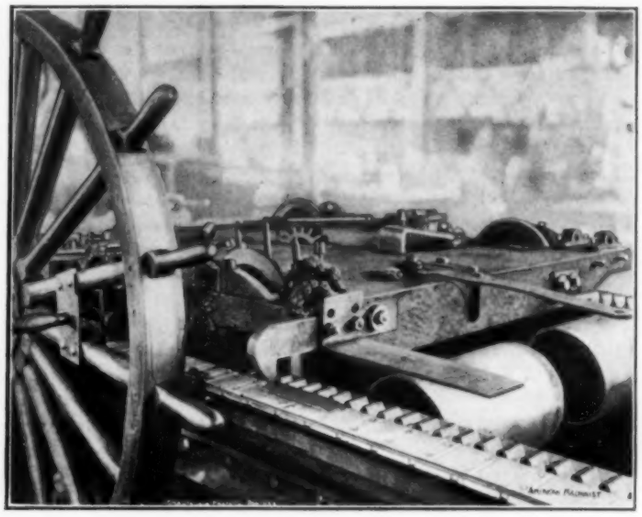


FIG. 18. TEMPLET AND REGISTERING PAWL OF PUNCH

How I Began to Write for the American Machinist

BY THOMAS D. WEST

[The following interesting experience is condensed from the *Industrial World* of May 22—EDITOR].

During my travels as a young man, I always made sketches of any novel appliance that was new to me, as well as notes on ways and means of doing work. These grew in number until I had a large case full of them. There is little question but what my possessing the above matter along in 1880 was the original cause of my starting to write articles on practical founding and which came about after the following manner:

A neighbor, John Doolittle, and an excellent machinist by trade, working in Cleveland, came to observe my collection through his teaching me evenings to be a better draftsman. One of these evenings he asked me if I had ever written any articles on founding. I told him no; and, further, that I never had such an idea in my head. He replied that he thought I would make a most excellent writer, and he was going to send some of the editors after me. I begged of him not to do so, as I had no literary training and not the least conception of what I might write or how to get at it. Nevertheless, several letters came from the late Mr. Bailey, chief editor of the AMERICAN MACHINIST, strongly urging me to make a trial until, finally, I consented to do so. At this time I had charge of a Cleveland foundry, now extinct, in which I was called "The Boy Foreman." Leaving this position I started work as the leading molder for the Cleveland Rolling Mill foundry, and

FIG. 19. RACK OF STEEL TEMPLETS FOR PUNCHING MEMBERS OF THE LOCK GATES

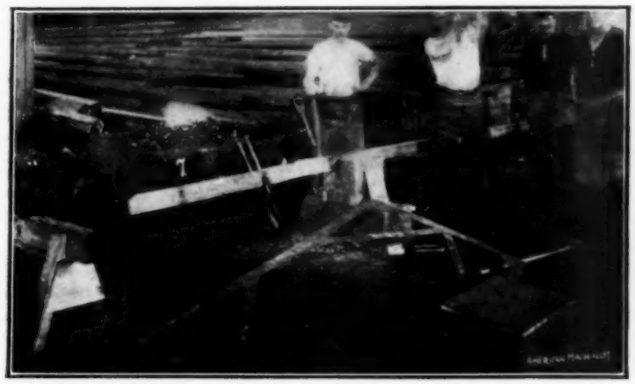


FIG. 20. FORGING A WATERTIGHT FRAME

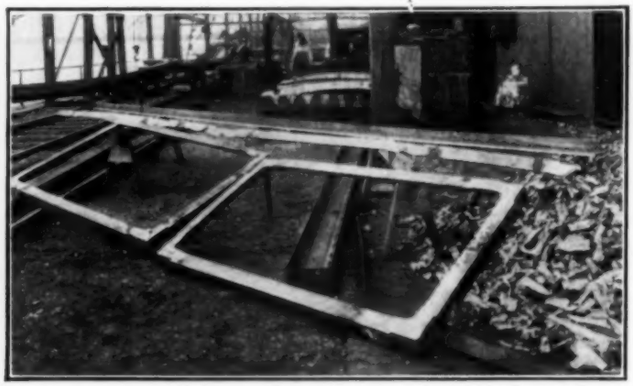


FIG. 21. A FINISHED FRAME AND THE PRODUCT OF THE VARIOUS OPERATIONS IN MAKING IT

while being employed with this firm under the late John Stoney, I noticed they had a practice of burning the necks on rolls that had been broken off, something that in all my previous travels I had not seen nor heard of. As this was a subject I felt confident would interest all good molders, founders and the like, I concluded to take it for a trial article.

It was not long before I had the article ready for mailing to Mr. Bailey. For several weeks after this I watched with a kind of dread for the article; and not seeing it appear inside of a month I concluded it had found the waste basket, and put the whole matter behind me. In the interval I had been solicited to plan and take charge of a new foundry for the Variety Iron Works, of Cleveland, on him for having got me into such a mess. He only laughed at me, and he takes delight to this day in saying I was scared white, with my hair standing on end.

The Lack of Precedent

The writers and readers of foundry articles today must remember that 30 years ago there were no precedents to guide one in knowing how the venture I undertook in first writing practical articles might be received by the craftsmen, etc., of the trade. Again, I was at this time little more than a boy in a business where its tradesmen generally vied with each other in withholding any information they might possess. What one might know of the business ticles, when in reality I could not think of another subject that I felt would be worthy of publication. At this period a turn came that I had not contemplated. This was the receipt of flattering letters from engineers, presidents of machine-construction plants and some foundry managers, a part of whom I believe were urged on by Mr. Bailey to influence me to write more articles as Mr. Doolittle had, no doubt, given them great expectations of what I might be able to do. It all had the intended effect; and I soon found myself seriously considering what I might give as a second article.

It will be well to mention at this point that I could not allow myself to think of writing anything that would not command the grave attention of the oldest

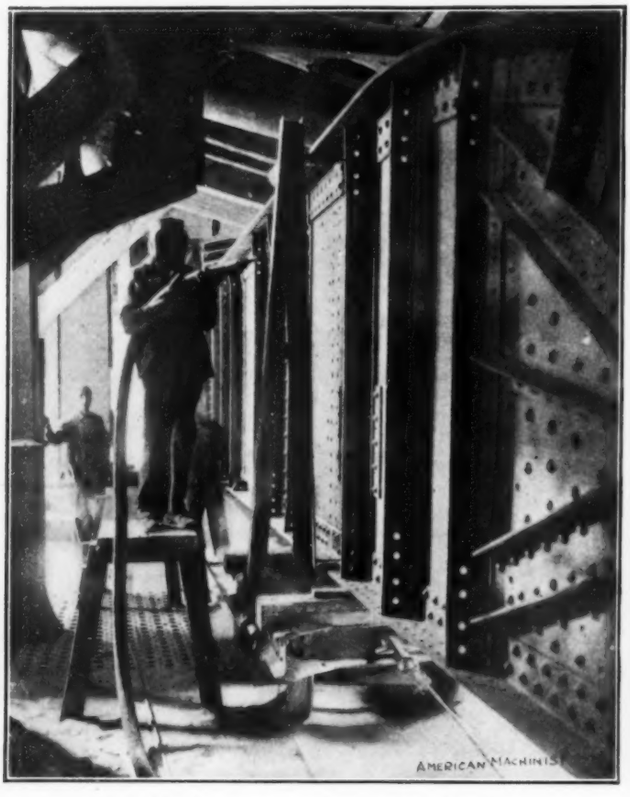


Fig. 22. Interior of Sand-blast House

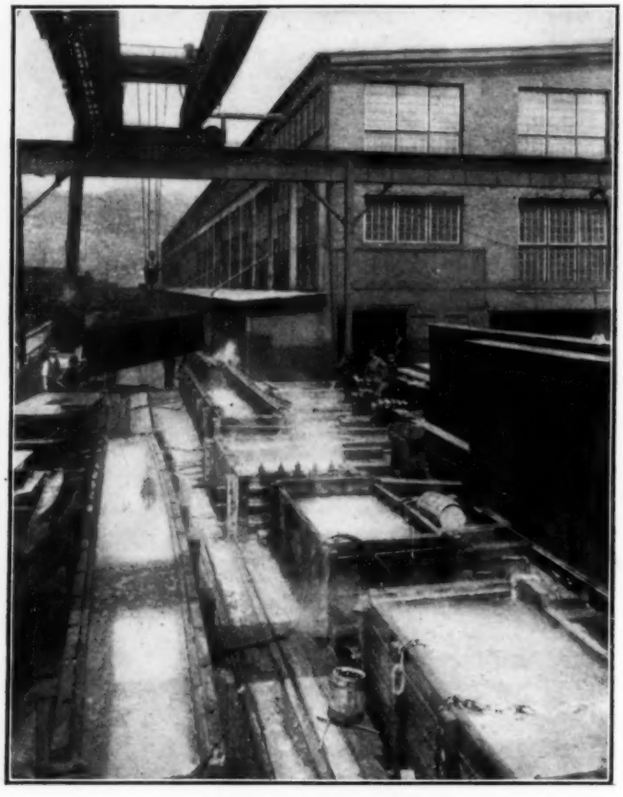


Fig. 23. The Pickling Plant

One day, while standing on a ladder investigating an oven's damper, Mr. Chamberlain, one of the proprietors, approached me, asking my initials. I told him. "Thomas D. West?" he echoed—"well, they have you out in great shape this week in the American Machinist"—and walked off.

At a loss to comprehend his "great shape," I was embarrassed and lost no time in reaching home that evening to obtain a copy of the paper, which, to my dismay, had the article spread out in a very striking manner all over the front page. The sight caused me to feel mad, glad and perplexed; and before attempting to read the article I hunted up my friend Mr. Doolittle, to vent my spleen he obtained through hard initiative physical labor in assisting workers, many of whom, if they had the power, would take all knowledge of the art to the grave with them in the thought of glorifying the unmeasurable self-importance. As young as I was at this time, I had always contended that I owed the world something for what it was tendering me. This point influenced me more than any other in finally making the start I did. However, I certainly would have felt better if the American Machinist had started me in by having my first article appear in some dark corner of its paper.

Among the difficulties following the prominence given my first article, was the persistence of editors for more ar- and most experienced molders or foundrymen of that day as well as the novices. Of a sudden, as it were, during my studies for another article, the thought came to me: What are the principles involved in the various phases of melting, molding, etc.? In following this line of reasoning I was soon awakened to the fact that I, like most all others, had been a mere imitator, for from inquiry of the oldest and best among them I soon learned they knew of all this no more than I. With a discovery of the great, expansive field for original and research work that lay before me, it was not long before I was mailing the American Machinist an article at least every two weeks.

Machining Magneto Parts

By Ethan Viall*

Tools and fixtures used in machining pole pieces.
Novel faceplate clamping fixtures.
Standard universal chucks fitted for gear-blank work.

*Associate Editor.

So much of the successful running of an automobile depends on the ignition system that unusual care is exercised in its selection by builders of even the cheapest cars, and it goes without saying that a magneto that was poorly made, even if well designed, would soon go into the discard, but the reputation of a well designed, well made and carefully tested magneto creates a demand that grows faster than the factory resources and necessitates constant additions in room, equipment and men.

In the factory of C. F. Splitdorf, New York City, maker of the Splitdorf magnetos, the greatest care is exercised in every department, to have their machines as near perfection as possible before shipment.

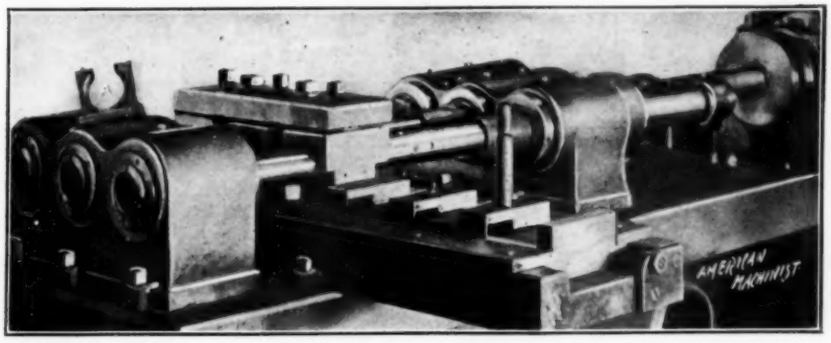


FIG. 1. BORING OUT MAGNETO-POLE PIECES

In this article a number of jigs and fixtures used in manufacturing magnetos, are illustrated and described through the courtesy of C. F. Splitdorf and Superintendent Walbrun.

BORING AND FACING THE ENDS OF POLE PIECES

Magneto pole pieces are bored out three sets at a time on a Binsse boring machine fitted as shown in Fig. 1, one of the sets, consisting of a base and two pole pieces held together by screws, being shown at *A*. These pole pieces and bases are first milled, drilled and tapped and then assembled in the cradle shown in Fig. 2; then after boring as illustrated in the first halftone, they are mounted on a mandrel *A*, Fig. 3, and the ends trued up to size, using a forked tool holder *B*, carrying two cutters. This type of toolholder is used on many jobs throughout the factory.

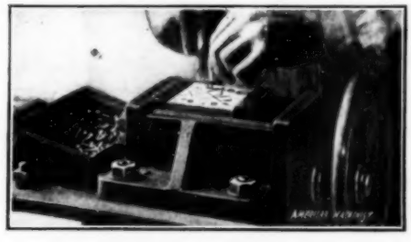


FIG. 2. AN ASSEMBLING CRADLE

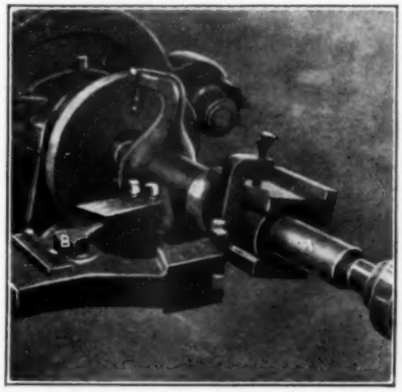


FIG. 3. FINISHING BOTH ENDS OF POLE PIECES AND BOTTOM, AT ONCE

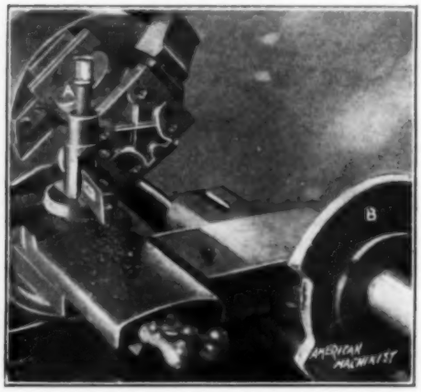


FIG. 4. CHUCK JIG AND TAILSTOCK SQUARING PLATE

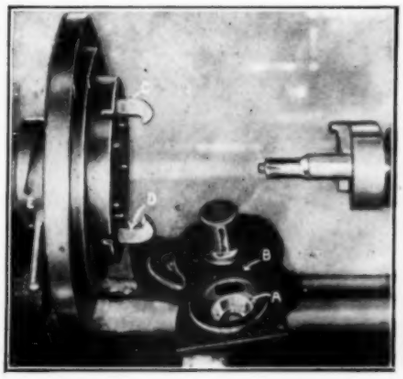


FIG. 5. CAM-OPERATED CLAMPING FIXTURE

FIG. 6. A PIECE IN POSITION

FIG. 7. ANOTHER CAM MOVEMENT

Great care is exercised to have the parts interchangeable, but cumulative errors are removed by various machining operations after some of the pieces are assembled, and in the case of the pole pieces and base, they are placed over a locating plug *A*, in the jig shown in Fig. 4, and the bottoms carefully faced off so that the center point of the bore in the pole pieces will be the same distance from the bottom of the magneto in all cases. It will be seen that the basis of the jig used, is a two-jawed universal chuck on the face of which the locating plug has been set. The base of the magneto is set exactly at right angles to the cross slide, just previous to the final tightening of the jaws, by running the plate *B* in the tailstock, up against it, and then giving the chuck screw a final turn.

Die-cast parts, as a rule, are considered accurate enough for all ordinary purposes, just as they come from the molds, but magneto parts made by the die-casting process are carefully machined so as to have the important dimensions absolutely accurate.

Cam Operated Clamping Fixture

Die-cast magneto fronts are bored out at *A* for breaker boxes and turned at *B*, Fig. 5, while held in the fixture shown attached to the lathe face plate. The casting is located in this fixture by pins on the face which enter the screw holes of the casting, claws *C* and *D* operated by lever and cam ring *E*, holding the piece firmly in place.

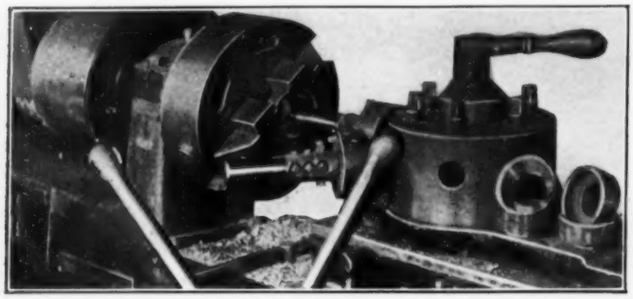


Fig. 8. Boring and Trimming Breaker Boxes

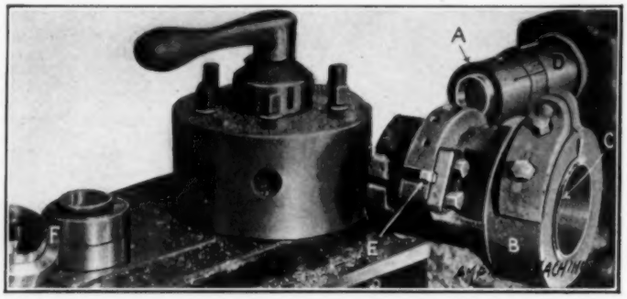


Fig. 9. Piloted Box Tool for Finishing Outside

The center hole is bored out in the fixture shown in Fig. 6, using the breaker box seat just finished to locate by in order to have the center distances of the center hole and the breaker box exactly right, a plug set into the fixture at *A* over which the breaker box seat just fits, answering the purpose. The clamping claws *B* and *C* of this fixture, while similar to the ones previously shown, are operated in a different way as will be seen from Fig. 7. In this halftone *A* and *B* are the ends of the claws shown in Fig. 6; *C* and *D* are rollers and *E* is a cam operated by means of a pin thrust into hole *F*. As will be easily seen, the claws may be drawn tight against the casting or loosened by a quarter turn of the cam.

A Box Tool with a Pilot Bushing

Breaker boxes, referred to above, are bored out and the edges trimmed in a Dreses turret lathe fitted with a two-jawed chuck having shaped false jaws, as shown in Fig. 8, the pilots of the turret tools being guided by a bushing in the spindle. The outside is then finished with a box tool, the breaker box being placed on an expanding chuck at *A*, Fig. 9 A feature of this operation is the way the box tool *B* is guided during the cutting by the hardened sleeve *C* which fits over the part *D* on the nose of the spindle, and acts as a pilot, the cutter for the outside of the breaker box being set into the box tool at *E* and the other cutters farther back on the opposite side. A number of the finished breaker boxes are shown at *F*.

Chucks for Gear Blanks

Magneto gear-blank castings are drilled, reamed and faced, as shown in Fig. 10, while held in a universal three-jawed chuck, the jaws of which have been turned and bored to shape and to the face of which a special plate has been fitted. After one side has been finished, the gear blank is placed in a similar chuck, Fig. 11, and the other side machined with the formed tool *A*, the right thickness being obtained easily by using the stop *B*, which may be adjusted at any time.

The blanks are next placed 19 at a time on a mandrel and the circumference finished, after which the teeth are cut in an automatic gear cutter.

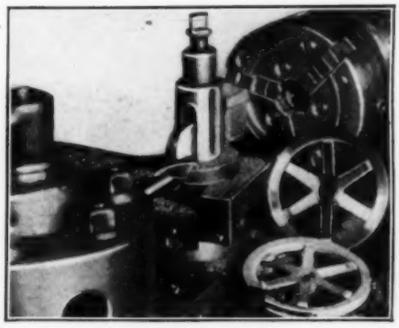


Fig. 10. Finishing Center Hole and One Side of Gear Blank

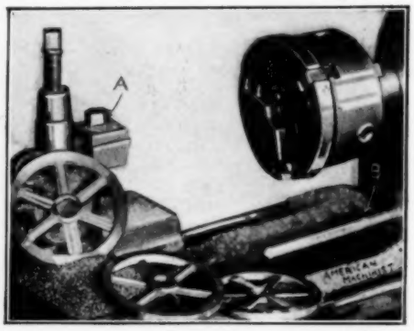


Fig. 11. Finishing Opposite Side of Gear Blank

Tool Clearance

By Andrew G. Brown

The tool-making branch of mechanical engineering is rapidly becoming an exact science. Ambitious men are ready to grasp every little point that will help to make better work, a little faster time, or add to the life of the tool.

In my experience in many shops I have found a tendency to make punches fit the die too closely. This is a point of great importance as can be proved by any competent toolmaker.

It would be of little use to try to compose a table of clearance on account of the variety of cutting qualities of various metals, as well as the compositions and tempers of each. Let the size of the die be equal to the size of the punch plus two-tenths of the thickness to be cut for a first trial.

Experience has taught me that the greater the clearance allowed between punch and die, the better the resulting blanks, and the longer the tools will remain sharp; provided the metal is cut before it begins to draw into the die.

In most cases the "bur" which the toolmaker thinks is caused by too great clearance is really caused by too little. The blank will always be found to be a little larger than the punch regardless of the size of the die.

Now if the die is a close fit for the punch it follows that the blank will have to be forced through the die which will cause a "bur" to be turned up on its edges, while the same blank would drop or push easily through the die in which clearance had been allowed. Again, if the press tools changed position ever so little (which is sure to happen) the close-fitting punch and die will begin to be dulled by their action against each other, while the cutting edges protected by a sufficient clearance never come into contact. The great importance of having this clearance evenly divided on all sides of the blank will be recognized at once.

I believe in the use of the subpress even with open tools when large quantities of blanks are to be made.

When open tools must be used, great care in setting is necessary. Narrow strips of metal equal in thickness to the clearance on one side, of punch and die, may be cut and bent to a right angle, and placed at intervals around the cutting edge of the die.

Thus the punch may be entered with an even clearance on all sides. Above all things see that the parts of the tools and press are secured.

With a careful observance of these simple rules, a surprising amount of trouble will vanish, presses may be run at a higher speed, tools remain sharp longer, and better work result.

Westinghouse Balancing Machine

By S. B. Redfield

With the present extensive use of very high-speed machinery, the question of running balance is of vast importance and many articles on this subject have appeared in the technical journals. One important piece of apparatus requiring careful running balance is the steam turbine, and the accompanying illustrations show a device for securing this condition, used by the Westinghouse Machine Company of East Pittsburg, Penn.

This device, which is the invention of Francis Hodgkinson and is patented, is based upon the principle that if a cylindrical body is divided into a series of elementary disks, and each disk is put into static or standing balance by proper distribution of weights, the cylinder formed by again assembling these disks together, will be in running as well as standing balance.

A device used by the Westinghouse Machine Company for putting steam turbine rotors into running balance.

If a cylindrical body is divided into elementary disks and each of these put into static balance, the assembled cylinder will be in both static and running balance.

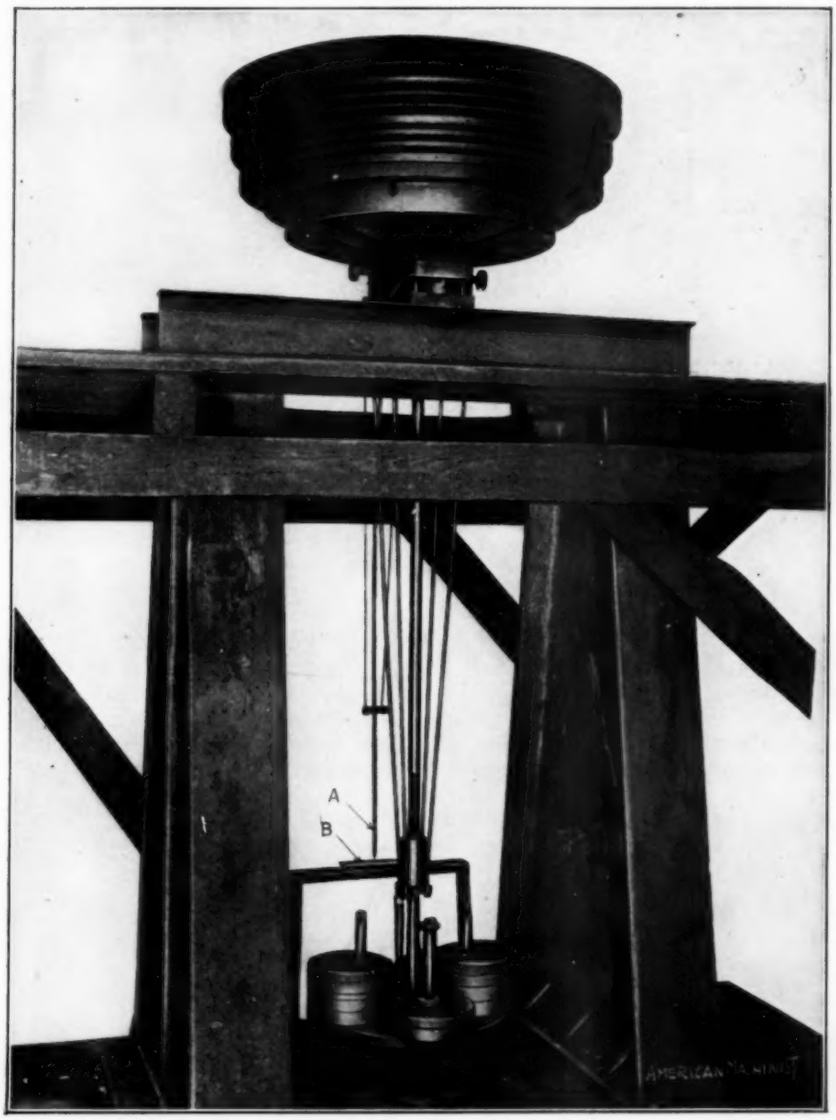


FIG. 1. DEVICE FOR PUTTING STEAM-TURBINE ROTORS INTO RUNNING BALANCE

THE ELEMENTARY CASE

To appreciate this truth, we may examine Figs. 2 and 3. In Fig. 2, assume that the cylinder is out of standing balance, it being heaviest at *A*. By ordinary methods of static balancing, it will not be possible to tell at just which portion of the cylindrical length this heavy spot is located, and to balance the cylinder statically a proper weight might be put anywhere along the other side, as at *B*. With *A* and *B* of equal weight and at equal distances from the axis, the cylinder will appear to be perfectly balanced, as determined by any process of rolling on knife-edge parallels. But, as has been shown in other articles, if the cylinder is now rotated on its axis, it will be found that the centrifugal forces produced by *A* and *B* will cause a rocking couple which will cause excessive vibration of the cylinder. Thus, although in standing balance, it is not in running balance.

By some of the running-balance machines now on the market, it could be determined that the application of weights *D* and *C*, equal and opposite to *A* and *B* respectively, or of proportionate weights and distances to give equal centrifugal

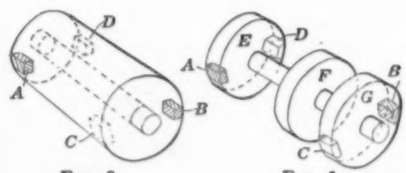


FIG. 2 FIG. 3

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SECURING RUNNING BALANCE BY STATICALLY BALANCING COMPONENT DISKS

and equal static moments, would put the cylinder into perfect running balance.

DIVIDING INTO DISKS

Now suppose that the cylinder could be sliced up into disks, of which we will say *E*, *F* and *G*, Fig. 3, are three. If these disks were separately tested on balancing parallels it would at once be found that disk *E* is heavy at *A*, which could be balanced by suitable weight *D*. Then also, disk *G* would be found heavy at *B*, which weight *C* would balance. Next, if all the disks are assembled again and keyed to the shaft, Fig. 3 resolves itself into the cylinder shown in Fig. 2, which, with the four weights *A*, *B*, *C* and *D* we would have found to be in *running* balance by the running-balance machine. And this result has been obtained by the process of putting all the elementary disks into standing balance, each by itself.

This principle may include any number of disks, but it has been found that the

sensitiveness of the ordinary balancing parallels is not sufficient for the accuracy required in a high-speed turbine. This lack of sensitiveness would occur in testing when the heavy spot was near the bottom and could not exert sufficient turning effort to overcome the friction of the heavy cylinder on the parallels. Also, this would be the case when the cylinder was only very slightly out of balance; not enough to start a rolling motion. For these reasons the Westinghouse Company was not satisfied to depend upon the ordinary balancing parallels and has resorted to the use of the Hodgkinson device here illustrated.

The Device for Turbines

Steam turbines usually are made in short sections of cylindrical or disk form, and Fig. 1 shows one of these disk sections being tested for standing balance in this machine. The balancing machine consists of a turntable *A*, Figs. 4, 5 and 6, mounted so as to rotate upon spindle

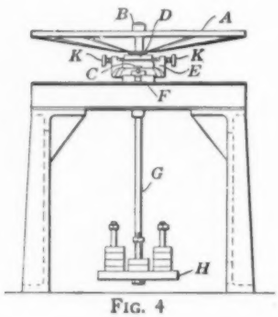

Fig. 4

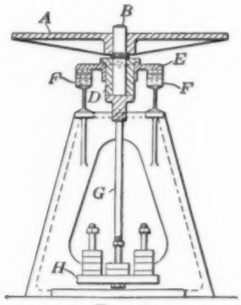

Fig. 5

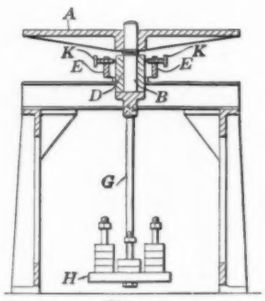

Fig. 6

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Essentials of Westinghouse Balancing Machine

B in socket *D*. Socket *D* is supported by flanges resting upon open beam *E* and, while it closely fits the opening in *E* on one axis, it may be slid along the axis at right angles across *E*, by means of the two adjusting screws *K*. This is most clearly shown in Fig. 6. Beam *E* rests upon knife edges *C*, which in turn rest in self-alining sockets in blocks *F*; these latter rest upon the main supports. *H* is a counterweight hanging on rod *G* which is rigid with *D*.

To describe the operation of the machine we may refer to Figs. 7 to 10 inclusive. Assuming that the turn-table and all the parts connected with it are first properly balanced, so that the upper surface of the turn-table will remain accurately in a horizontal plane during a complete rotation, the disk to be balanced is placed upon the turntable, most carefully centered with reference to the spindle and properly clamped in position. Four points, *A*, *B*, *C* and *D*, are located upon the periphery of the disk at 90 degrees from each other, at the same radius from the center of the spindle, and the hanging counterweight is adjusted so that the combined apparatus located upon the knife-edges will oscillate very slowly, indicating that the center of gravity of the combined mass must be just below the plane of the knife-edges. The spindle socket is now moved along the beam by means of the adjusting screws until the beam is balanced in the horizontal position. This will bring the point *X*, which indicates the position of a vertical line passing through the center of gravity, into the vertical plane in which the knife-edges are located, as in Fig. 7.

Next, the turntable is turned 180 degrees, so as to bring the point *X* into the position represented in Fig. 8, and thus out of alinement with the knife-edges, in which position the beam will be deflected from its previous condition of balance. Sufficient weight should now be added at some point, as at *D*, to bring the beam again into the position of horizontal balance. The amount of weight added at this point *D* we may assume to be *n*.

The turntable is now turned 90 degrees and the beam moved by means of the adjusting screws until it is brought into

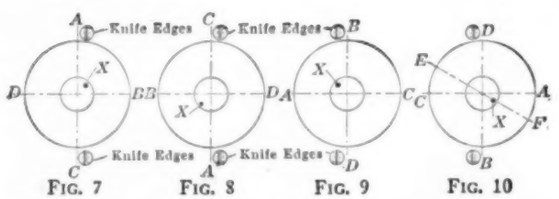


Fig. 7 Fig. 8 Fig. 9 Fig. 10

Diagram of the Process of Balancing

the horizontal position, when the point *X* will be in the position indicated in Fig. 9. The turntable is now given another movement of 180 degrees to the position indicated in Fig. 10, and weight added at some point, as at *C*, sufficient to bring the beam again into the horizontal or balanced position. The amount of weight added at the point *C* may be represented by *n'*. It remains now to locate the line *E F* which lies in both the geometric center and the plane of the center of gravity. This may be done by determining the angle Θ, which is made by the lines *E F* and *A C*.

By equating moments about the axes and throwing out small factors which would not materially affect the result, the following expression is obtained:

$$Tan.\ \Theta = \frac{n}{n'},$$

in which *n'* must be the greater weight.

Then, the weight necessary to be added to point *E* or to be taken away from point *F* equals:

$$\tfrac{1}{2}\ cos.\ \Theta\ .\ N',$$

N' being the greater of the two weights.

The object of shifting the turntable so as to bring the center of gravity over the knife-edges is to secure just double the effect of the faulty balance when the turntable is turned 180 degrees. This is indicated in the above formula by the factor ½.

Finding the Weight Necessary to Balance

Final balancing of the turbine disks or sections is obtained by drilling at the points found by this method and tables are provided giving the depths of holes of various diameters to remove certain weights of metal. Then, when all the statically balanced disks are assembled, the combined parts are found to be in running as well as static balance.

Accuracy and Delicacy

An indication of the precision with which the work is done is found in the care used to center the parts being balanced, which are large and heavy. When they are placed in position on the turntable, feeler gages differing by 0.001 inch are used between the bore of the ring and the centering boss on the turntable. The ring is shifted until the same gage will enter and fit the gap between ring and boss at the four ends of two diameters at 90 degrees apart.

The horizontal position of the turntable is determined by the pointer *A* and scale *B*, shown in Fig. 1, and to secure accuracy, the apparatus is caused to oscillate equally on either side of the zero point, as is the practice with delicate chemical balances, thus eliminating even the small friction of the knife-edges.

After you think you've done a fine job of grinding or polishing, look at it with a powerful microscope. It may be a trifle discouraging at first, but it will spur you on to finding better materials and to doing better work, providing, of course, that it needs to be better for your particular purpose.

Machining Gun Barrels and Stocks

Editorial Correspondence

Methods of manufacture used in a western gun shop.

Matting the rib and chambering the barrels.

A special gun barrel reaming machine.

Forming and fitting the stocks.

The Union Arms Company, Toledo, O., makes a line of double-barrel and repeating shot guns that needs no introduction to many of the readers of the AMERICAN MACHINIST, but a number of their shop methods, while not uncommon to gun shops, are practically unknown to the average mechanic.

A few of the different models of guns manufactured are shown in Fig. 1, a feature of some of their repeating shot guns being the matted rib sweated to the top of the barrel, which makes sighting easier and consequently increases the game bag of a day's hunt. This rib has, of course, been used on double-barreled guns for years, but few of the later single-barrel repeating shot guns have been provided with one except on special order at the customer's expense. For the benefit of those who may wonder why a matted rib is so superior to a plain rib or plain barrel, it may be explained that a matted rib is covered with fine lines which break up the light that would otherwise reflect and confuse the sight. These lines, whether parallel or otherwise, are so made that not only is the reflection broken up but the eye is actually guided to the sight on the front end of the barrel.

Our first article will deal entirely with barrels and stocks, but in a subsequent article various gun parts will be shown and the principal machinery operations described, and we wish to extend our thanks to general manager E. A. Williams, Jr., and superintendent N. R. Van Horn for the courtesies which make these articles possible.

All the gun barrels used by this firm are imported from Germany and are received already bored.

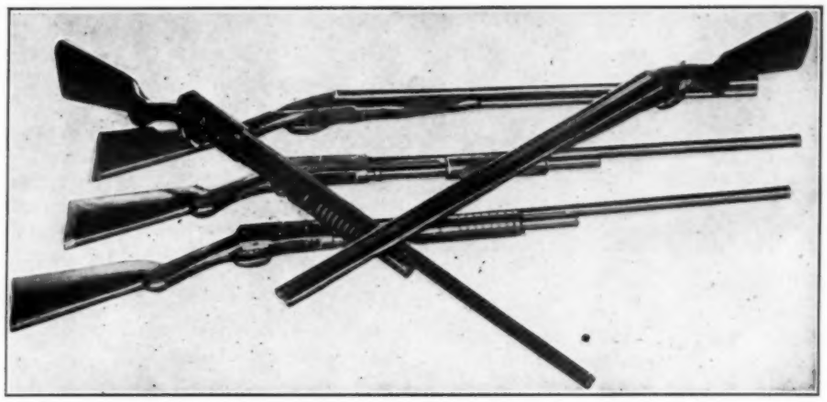


FIG. 1. A FEW OF THE MODELS

MILLING, MATTING AND CHAMBERING

In sending the double barrels through the shop, they are first assembled on jigs that space and line them up properly while the rear lug is brazed in, after which the top and bottom ribs and fore-end loop are sweated on, then the rear lug is straddle milled and formed and next the rear ends of the barrels are surfaced off, as shown in Fig. 2, the jig being so made that the barrels are held at just the right position with but little care exercised in the setting.

The matting of the top rib is done by placing the barrels in a jig on a planer, as shown in Fig. 3, and using a somewhat pointed tool and a coarse feed, the roughing off of the rib and the matting being done at one setting.

Barrels are chambered out for shells by placing a reamer in the lathe chuck so that it runs true and then feeding the barrels onto the reamer, the other end of the barrel being reamed resting on the tailstock center, the feeding being done by screwing in the tailstock spindle and the barrels kept from turning by a long-tailed wooden dog, as shown in Fig. 4.

A SPECIAL REAMING MACHINE

The barrels as purchased, are 0.005 inch under size and are reamed out in the shop-built machine shown in Fig. 5. In this machine the barrels, either single or double, are clamped to the carriages *A A A* and are reamed out by floating reamers fastened to rods run down through them. Two single barrels are shown at *B B* and two double barrels at *C C*, being clamped at each end of the carriage as shown. The carriages run on guides *D D D D D D* and are fed downward by the screws *E E E*, which are turned through gears run by the bevel gears *F F F*. The rods to which the reamers are fastened are also geared to the

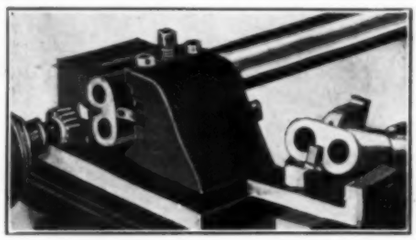


FIG. 2. MILLING ENDS OF DOUBLE BARRELS

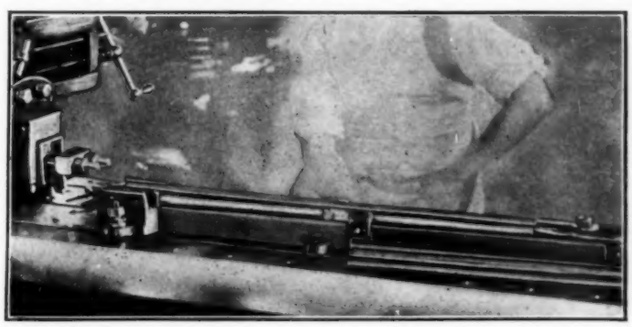


FIG. 3. MATTING TOP RIBS

FIG. 4. CHAMBERING FOR SHELLS

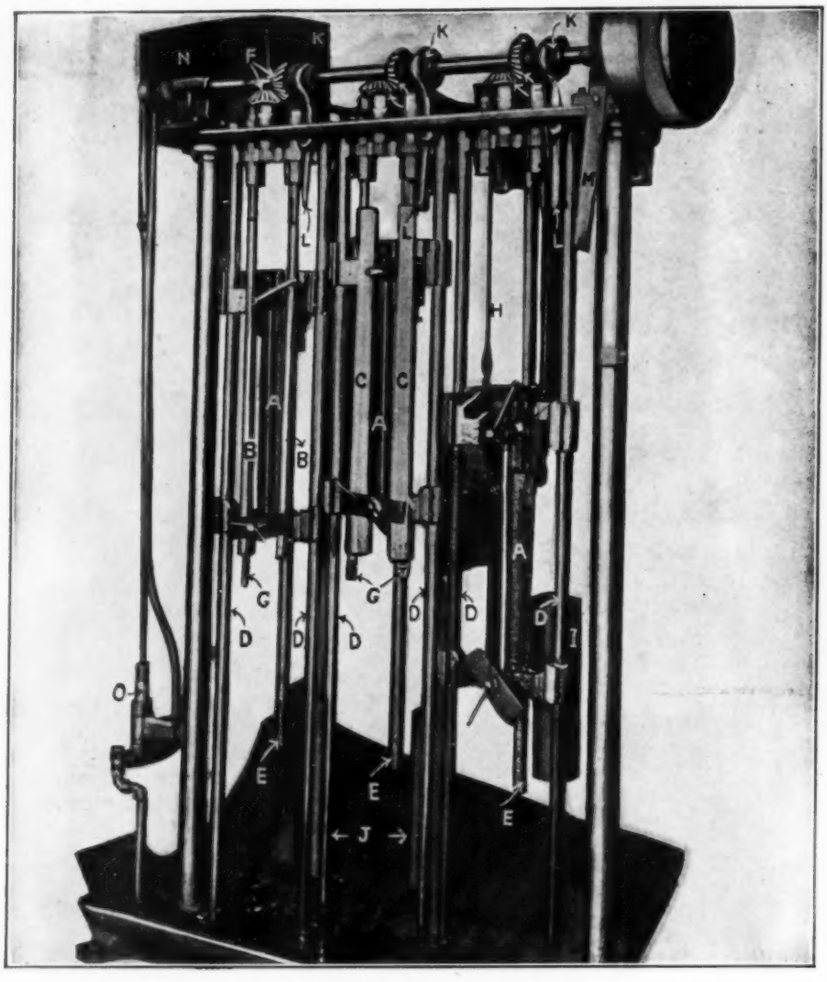


FIG. 5. BARREL-REAMING MACHINE

bevel gears, the gear cluster being arranged so that one bevel-gear set runs one feed screw and two reamers, the reamers, of course, both turning right hand as well as the screw, which is cut left hand. Three of the reamers are shown just ready to enter the barrels at *G G G*, the one in the second single barrel being drawn up too far to show.

The right-hand carriage is shown empty in order to give a better idea of its construction and the way it is counterbalanced, the rope which runs over a pulley being shown at *H* and the counterweight at *I*. The counterweights for the other two carriages are shown at *J*. The carriages may be run up or down by hand, by releasing the feed screws by means of half nuts on the back of the carriages similar to those in a lathe apron.

Each bevel gear may be thrown out or in separately, by means of clutches *K K K* on the driving shaft operated by the hand levers *L L L*, and the entire machine is stopped by shifting the belt on the driving pulley with the lever *M*.

Oil is run down inside of the barrels to the reamers through small stop cocks connected to the tank *N*, and as it runs down into the base it is pumped back into the tank by the small pump *O*, which is run by a pitman on the end of the driving shaft.

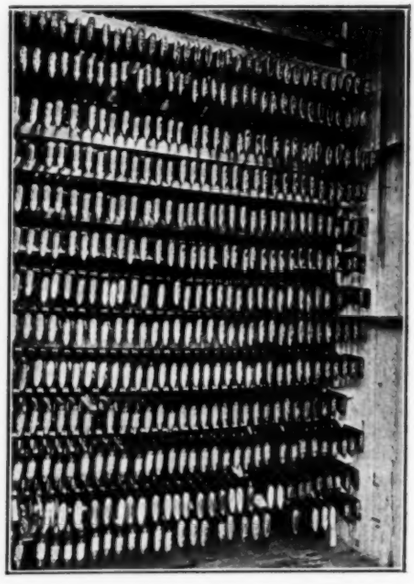


FIG. 11. A CORNER OF THE STORE ROOM

The machine just described is used both for straight reaming and choke boring, in the latter case the regular reamer not being run entirely through, a taper reamer being substituted for it while reaming the section close to the muzzle, the degree of taper or "choke" given the inside end of the barrel being varied according to whether the gun is ordered full or modified choke.

POLISHING THE INSIDE OF THE BARRELS

After the barrels have been reamed they are carefully polished inside, which is done by mounting them in the fixture on the lathe carriage shown in Fig. 6, and working the barrel back and forth over the swiftly revolving rod in the spindle, which carries a strip of fine emery cloth in a split in the end. The carriage is traversed by means of a

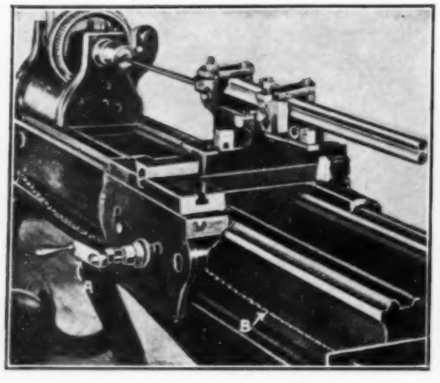


FIG. 6. POLISHING THE BARRELS

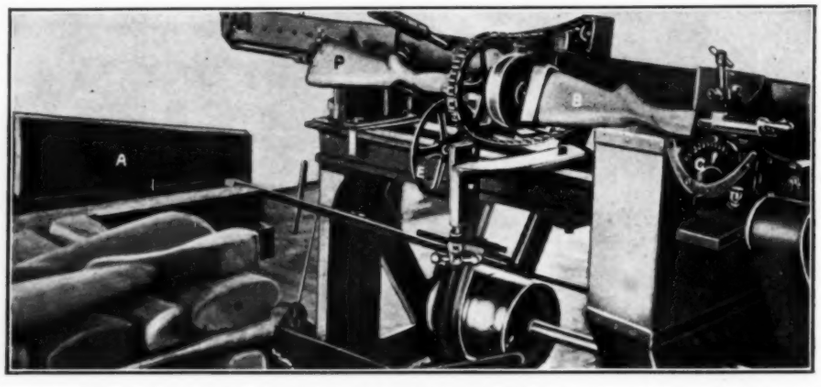


FIG. 7. ROUGHING OUT THE STOCKS

sprocket in the apron, turned by the handle *A*, which engages the bicycle chain *B* stretched along the front of the lathe.

The coloring of the barrels is carried on in practically the same manner as described on page 1002, Volume 33, Part 1, so as details of both the process and chemical formula are given, they will not be repeated here.

Making Stocks

The gun stocks are rough shaped in the machine shown in Fig. 7, known as a Blanchard lathe, after the original inventor. The wooden blocks from which the stocks are made come from the mills sawed to shape as at *A*. These blocks are placed between the lathe centers at *B* and roughed down with a coarse toothed "saw" *C*, the teeth of which cut both on the ends and sides, the eccentric motion being given the piece as it rotates, by the former *D*, which runs on the rim of the wheel *E*, the former and block to be cut being rotated by means of the sprocket and chain *F*, as the carriage feeds along toward the saw, the carriage, of course, being "hinged" so as to rise and fall according to the shape of the forming pattern.

The slots for the tangs are cut in the stocks in a rotary inletting or profiling machine, as shown in Fig. 8, using a router tool. The stock is placed in a jig which has outlines in its side plates, of the slots to be cut in the stock and these outlines guide the routing cutter.

After the tang slots have been cut, the breech blocks are fitted and the butt plates screwed on, as shown in Fig. 9, then the wood and metal are smoothed down with emery-covered wheels, and polished.

The checkering of the grip is done with a hooked tool having teeth on it similar to a thread chaser, the work being done by hand, as shown in Fig. 10.

Fig. 11 shows one corner of the room used for the storage of finished guns, data for rapid identification of various models being plainly chalked on the butt plates.

The Shop Plant and Spare Parts

By F. P. Strachan

Some time ago I took charge of a shop where no system, or method had ever been used, in dealing with spare parts for the machine tools and other appliances about the shop. The method I adopted may be of interest. There were, of course, a few spare pinions lying around, either in the general stores or hidden away in some cupboard and claimed by the head millwright.

In handling this matter, I first gave every machine tool, hoist crane, etc., a number; a brass number plate being fixed in some prominent place upon it. I then partitioned off a corner of the general stores, my idea being the grouping or centralization of all spare parts in one place. I also managed to make this the headquarters for the beltman, as it would be something to interest him in his spare time; the whole to be controlled from my office by a card system, indexing from the number already allotted to the machine. The spares were also given a number in addition to the machine number, for record purposes, on my cards; these cards giving other particulars such as the probable date upon which they would have to be replaced, etc.

This method, no doubt effected a considerable saving over the previous haphazard way of doing, or not doing, things, but it was not the success I anticipated. Too much time was wasted when any stoppage occurred before we got started again. If a main belt gave out the beltman would take a sort of survey of the surroundings and then look round for me for "the number of the spare belt," although he had a full list of cards giving the necessary information. I tried many ways of bringing him along but it was useless; he had the same excuse every time: "I thought, sir, you ought to know," and the millwright was very much the same way, and after a twelve-months trial I decided it was a failure and gave it up. My card system I retained as the data recorded was valuable to me, but I started a revolution in other matters.

Almost every spare part stocked I had brought as near as possible to the place in which it would be used.

Main driving belts were either hung on the wall or placed in a box affixed to the ceiling; in some cases the spare belt being actually on top of the pulley and within a few inches of its future path. Spare gears, I attached to their respective machines with bolt or setscrew as near as possible to their working position without being unsightly or very prominent. In some cases the spare wheels and pinions are already on the shafts ready to slide into place immediately their predecessor gives trouble. In dealing with a large planer which we cannot afford to have idle for any length of time, I found sufficient space in the pit to store all the spare parts, and they always "meet the eye" of the man who goes below to investigate.

With some machines I have the spares fixed to a board which is either hung on the wall or the machine housing and a box cover over the whole makes a very neat arrangement.

These methods I have carried throughout the works and although somewhat costly I am satisfied that it is a good investment; my only trouble being to convince some of the men, especially the beltman, that "I ought to know" when things go wrong so that I can duly record them for future reference.

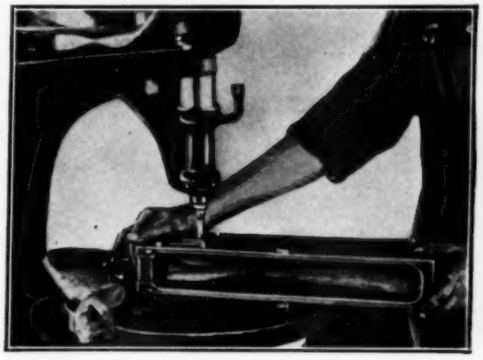


Fig. 8. Cutting the Tang Slots

Fig. 9. Fitting Stocks

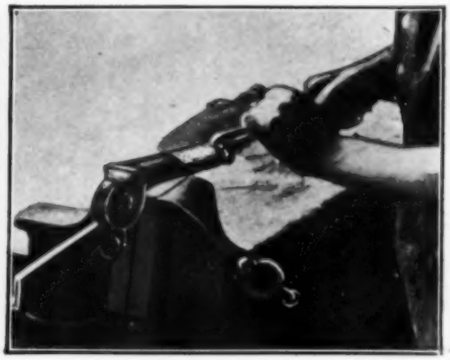


Fig. 10. Checkering the Grip

It may be well to remember that, in spite of the statement that the railroads could save a million dollars a day by adopting scientific management, they have almost the only shops in the country where real shop instructors are regularly employed. When we find a man who can turn out from 25 to 50 per cent. more work than the average, it may be well to consider whether he will not be worth more money to the shop if he can use his time teaching others how to come up to his level. It is an experiment worth trying in almost any shop.

Two Multiple Milling Jigs

By E. A. Suverkrop

Figs. 1 and 2 show multiple jigs devised by A. A. Avery, in charge of the jigs in the shops of the National Transit Company, Oil City, Penn.

The pieces to be held are brass valve-stem heads. The cylindrical part of *A* is not finished to any particular size, and for that reason some flexible method of clamping is necessary. The jig body *B* is of cast iron with vertical V-grooves on each side of its center member. On each side is a bar *C* of machine steel. The bolts *E* pass through these bars *C* and through the central member of *B*. Between the bars *C* and the member *B* light springs are threaded on the bolts to force the bars open when the nuts are slackened. The bars *C* are sawed about two-thirds through (just under each bolt head and each nut) to make them flexible, so that they will grip in spite of any slight inequalities in the sizes of the cylindrical shanks of *A*. The bar *D* is used when loading the jig only. It keeps the valve-stem heads in line till the bolts are tightened, after which it is driven out. The miller arbor carries three cutters, the center one dressing the inside surfaces.

Fig. 2 shows the jig for milling the rectangular slot *G* in the valve-stem heads *A*.

The body *B* of the jig is of cast iron. The ledge *I* at the back serves as a contact for the cylindrical part of the head *A*. A steel strip *H* serves as a stop against which the heads abut and the body of the bolt *D*, passing from end to end, acts as a third stop, the bodies of the head lying on it.

The line cut, Fig. 3, shows the clamping action. The bolt *W* has a large head *D*, a sliding fit in the member *J*. The body of *W* is a sliding fit in the central member *F*, and the member *K* is provided with a sleeve *V*, which is a sliding fit in it and also on the body of the bolt. The large washers *C* are a sliding fit on the body of *W*. When the valve-stem heads are placed between the washers *C* and the nut *E* is tightened, the heads and interposed washers on either side of the central member *F* are drawn and clamped solidly against *F*. Any slight irregularities in the heads are taken care of by the flexibility of the bolt *W* and the washers *C*.

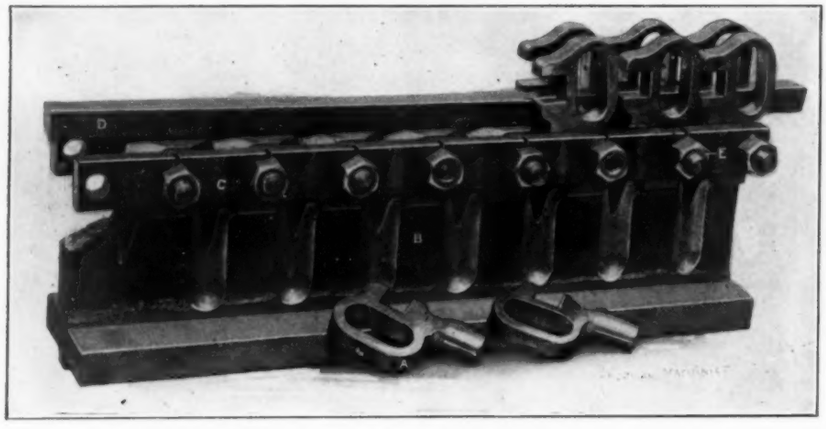


Fig. 1. Milling Four Sides with Three Cutters

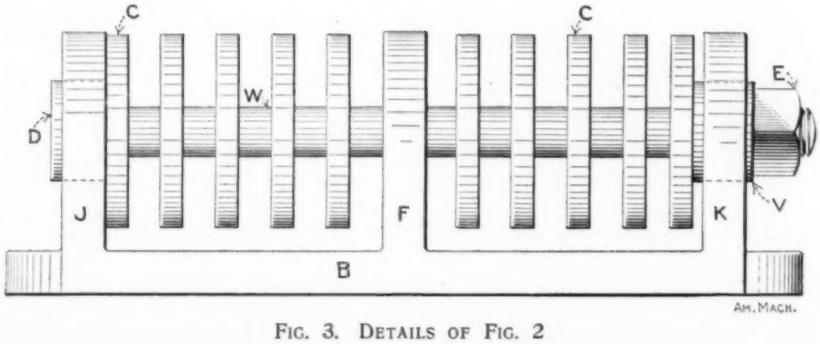


Fig. 3. Details of Fig. 2

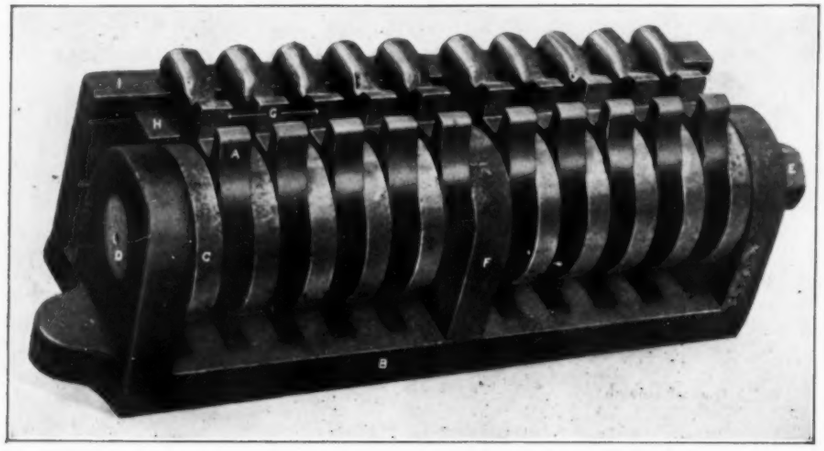


Fig. 2. Ten Pieces Clamped by Tightening One Nut

Furnace Gases

In connection with its investigations bearing upon the improvement of furnace conditions and on efficiency in the use of fuel, the Bureau of Mines has just issued a bulletin describing the apparatus and methods in use by the bureau for the sampling and analysis of furnace gases. In the preface it is stated that the furnace conditions prevailing both in small plants and in large industrial establishments in this country are frequently far from satisfactory. If such conditions are to be improved, they must be more thoroughly understood, and means must be found to insure complete combustion of the fuel, and yet to permit operation with such an excess of air as will result in the greatest efficiency. In this work it is stated the services of the chemist are indispensable. A very important problem is the determination of the small percentage of unburned combustible matter that escapes from the furnace in the flue gases. Under ordinary circumstances, so little as 0.1 per cent. of unburned combustible matter in a furnace gas is equivalent to about 1 per cent. of the fuel used; and for the determination of such small percentage of gas more accurate and refined methods are required than have ordinarily been available before. This bulletin, which is No. 12, may be obtained by those interested by writing to the director of the Bureau of Mines, Washington, D. C., with a request for a copy.

Sheet Metal Work for Automobiles

In plant No. 5 of the E-M-F Company, practically all the sheet-metal and forging work is done. Figs. 1 and 2 show a large Toledo double-action press drawing up cross members for the Flanders car, these being completed at one operation. This machine is used for embossing metal automobile seats and has a capacity of 500 per day. The material comes to this press cut to shape and with the sides rolled up. It will be noted that these sides are beaded or ribbed around the edges and across the back, and the edges are turned over to accommodate the reception of a wooden rail to which the trimming is fastened. This press completes the rib and edge turning in one operation. Formerly it was used for drawing bath tubs from sheet steel.

Fig. 3 shows a large press drawing a center cross member used in a 20-horsepower car, and is made from ⅛-in. sheet steel.

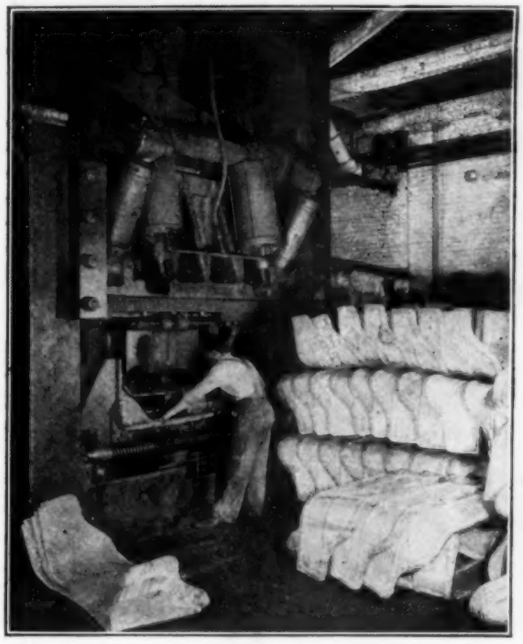


FIG. 1 TWO VIEWS OF LARGE PRESS FOR MAKING STEEL BODIES FIG. 2

"TACKING" PARTS WITH OXYACETYLENE PROCESS

Fig. 4 shows the brazing department. Rear axle housings are being brazed, as can be seen from those in the foreground.. These are entirely of sheet metal, the bell-shaped ends being drawn up in successive operations, as well as the cross piece for holding the brake shoe by means of the short tube shown at one end.

Oxyacetylene torches are used to a considerable extent, but not for brazing on account of the extreme heat of the flame. They are put to a rather novel use in the "tacking" of the parts together before brazing. The torch is used to simply fuse the metal at one or two points, holding the pieces firmly in place, which does away with all necessity for the usual wiring and holds them much more satisfactory in every way during the brazing operations.

The brazing torches are run by gas, as can be seen from the collection of meters in the corner of the room, and the exhaust pipe overhead with its numerous outlets reaching down into the room, keep the temperature at a very livable point.

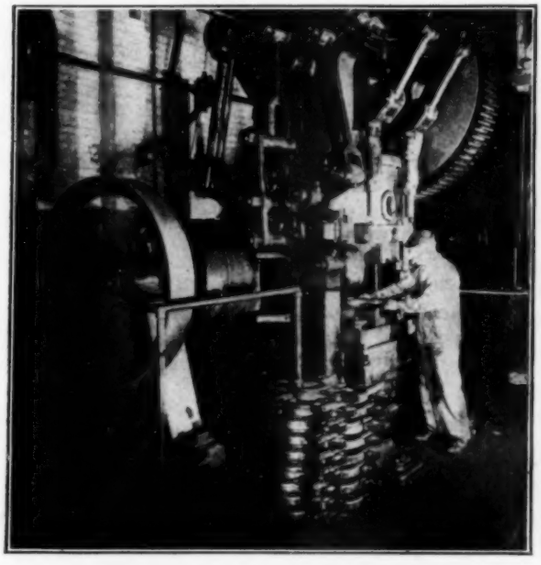


FIG. 3. DOUBLE-ACTING PRESS FOR CROSS MEMBERS FIG. 4. BRAZING REAR-AXLE PARTS

Extensive Use of Broaching Process

By S. E. Summers*

An extended use of the broaching press for a variety of operations often performed by other means less rapid and less economical. How the broaches are made so as to require the minimum of hand finishing.

*Manager, Detroit shops, the Chicago Pneumatic Tool Company.

In presenting this article it is not my intention to convey the idea that the method shown is the modern way of broaching, but simply to give the benefit of our experience, and this will serve to show what can be accomplished on a standard broaching press, which, when not in use for broaching, is busy on the many assembling operations which can only be handled on a press of this nature.

Broaches for Hexagon Holes

The halftone, Fig. 1, showing a portion of the press with broaches in place, will

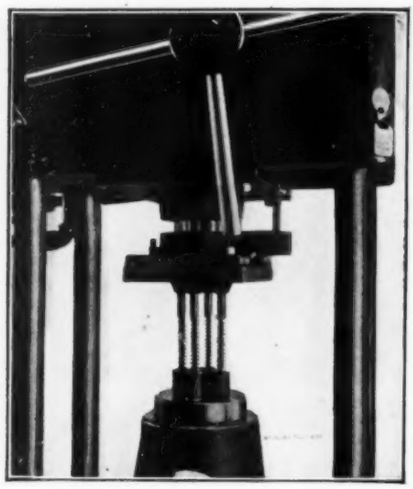


Fig. 1. Broaching Press

illustrate the method used in broaching the hexagon hole in our pneumatic-hammer chisel bushing, Fig. 2, the material of which is a high-grade carbon steel. The length of the piece is ⅞ inch and the hole measures 19/32 inch across the flats. We use four broaches simultaneously and at each stroke of the ram we complete one piece. The hole in the blank is bored to 19/32 inch and the guide on the broaches is made 0.003 inch under this size. The follower on the upper end of the broach is made long enough to allow the broach to drop through the work when the ram is at the end of the stroke. The broaches,

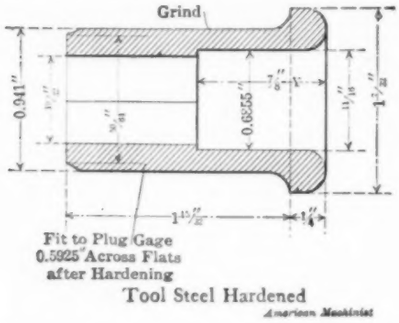


Fig. 2. Section through Bushing with Hexagonal Hole

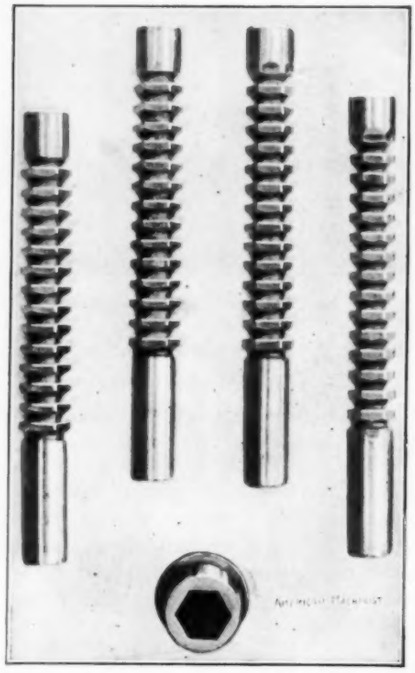


Fig. 3. Broaches for Hexagonal Hole

Fig. 3, are 6 inches long overall and have 14 teeth with ¼-inch pitch. The first six teeth advance 0.010 inch each or 0.005 inch on each side, as the first few teeth only cut on the corners as in Fig. 4, and no trouble is experienced, but as the cut becomes heavier it must necessarily be reduced, depending on the nature of the material and length of the cut. In this case we find that the teeth can be advanced 0.003 inch with full cut or 0.0015 inch on each side. I know of no rule that can be safely followed for the amount of cut to allow.

The first tooth on broach No. 2 is made the same size as the last tooth on No. 1 to assist in centering, and so on with No. 3 and 4. The last six teeth on the finishing broach No. 4 are made parallel to insure the size holding up to standard.

In the making of the broaches the blanks are turned and milled allowing a light cut for finishing. They are then carefully annealed, grooved and the teeth are finished with an end mill to give two degrees clearance. There is practically no hand work required to finish them except to give a little retouching. If a little care is taken in handling and annealing no trouble will be experienced in tempering and they will be quite straight. There will be no trouble from the chips wedging in the grooves if they are properly formed

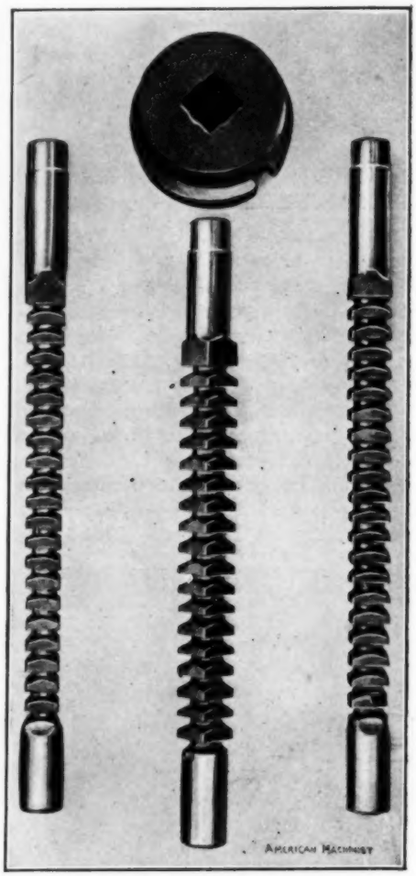


Fig. 5. Broaches for a Square Hole

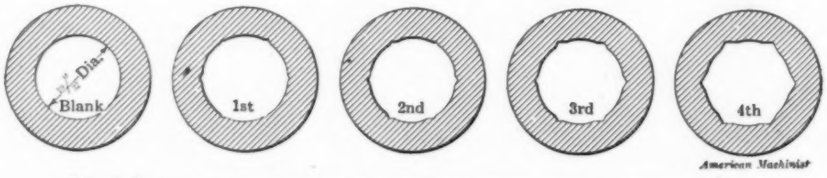


Fig. 4. Sequence of Operations in Broaching the Hexagonal Hole

and a little experience will determine what that is, depending entirely on the nature of the work, bearing in mind that all broaches must have plenty of chip room; if not there will be trouble from the teeth breaking.

Broaches for Square Holes

The broaches, Fig. 5, for the square hole in the piece, Fig. 6, are made practically the same as for hexagon holes.

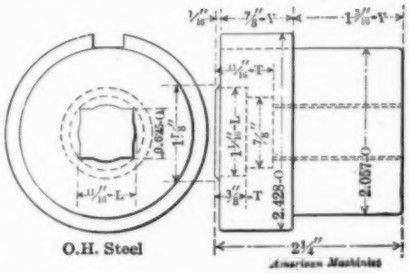


Fig. 6. Piece with Square-broached Hole

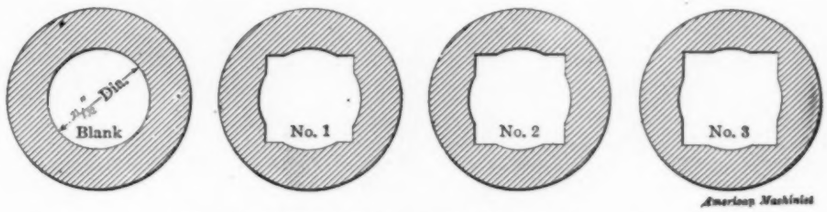


Fig. 7. Steps in Broaching a Square Hole

They are 10¼ inches long overall, the teeth are of 5/16 inch pitch and the hole when finished is ⅝ inch across the flats. The teeth advance 0.003 inch each or 0.0015 inch on a side. Three broaches are required for this piece with the work divided as in Fig. 7. In this case we drill the hole in the blank 21/32 inch as we do not require a perfect square.

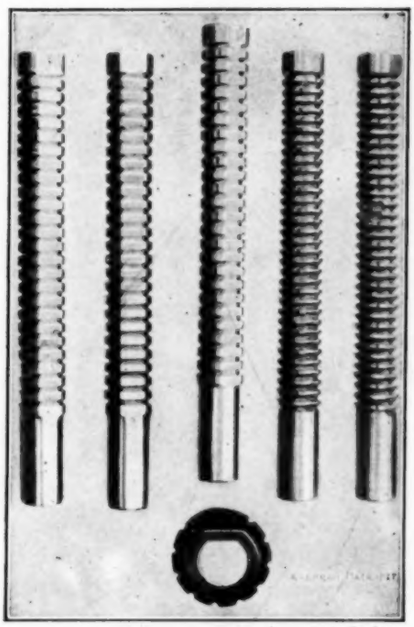


Fig. 8. Another Set of Broaches

Broaches for Round Holes with Flat Sides

From Fig. 8 it will no doubt be seen that trouble was experienced with the next piece. This is shown also in Fig. 9 and is one of the most difficult pieces we have ever had to broach. It is of tool steel and is 1⅝ inches long, bored to ⅝ inch diameter, and is broached to ¾ inch leaving one side flat, the face being 5/16 inch from center. The same method was used in making the broaches as for the others, except that they were ground all over after tempering, by which method we are able to have them perfectly straight. The three broaches with heavy teeth are practically new and found by experience to be a better design. The teeth advance 0.001 inch each or 0.0005 inch on each side; they are of ¼-inch pitch and the broaches are 8½ inches long overall. They also have longitudinal grooves to break the chips which is quite important in this case.

Broaches for Internal Gears

The broaches shown in Fig. 10 are extensively used on small internal gears, of which we have a great many of various sizes, one of which is seen in Fig. 11. They may look to the reader like very difficult broaches to make, but are comparatively simple. They are 8⅜ inches long overall, with a 1-inch hole running through, cleared in the center allowing ¾-inch bearing at each end.

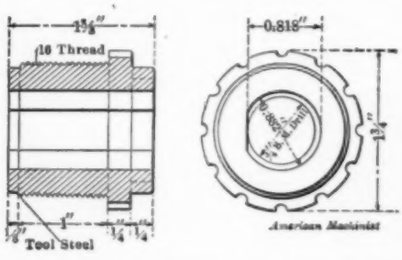


Fig. 9. Piece Broached with the Tools in Fig. 8

After roughing out the blanks they were annealed to remove strains, the grooves being then cut in the lathe and the teeth milled straight, practically the same as though making a long gear, as we have found by experience that no clearance is required. They are then tempered and ground in the groove to bring the cutting edge up sharp. The cutting is all done on the points of the teeth and the outside diameters of the teeth advance 0.006 inch each, leaving the last three teeth straight to insure the size being accurate. The cutting teeth are spaced ⅜ inch between centers. The gear being broached has a ½-inch face and 66 teeth of 20 diametral pitch. The blank is roughed out 1/32 inch large outside diameter and is held in a collar while being broached to prevent spreading, after which

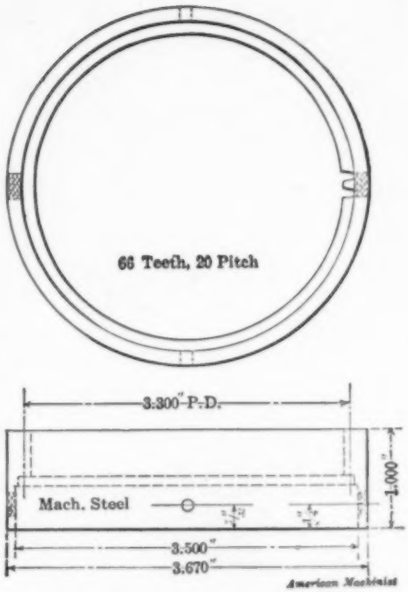


Fig. 11. Internal Gear to Be Broached

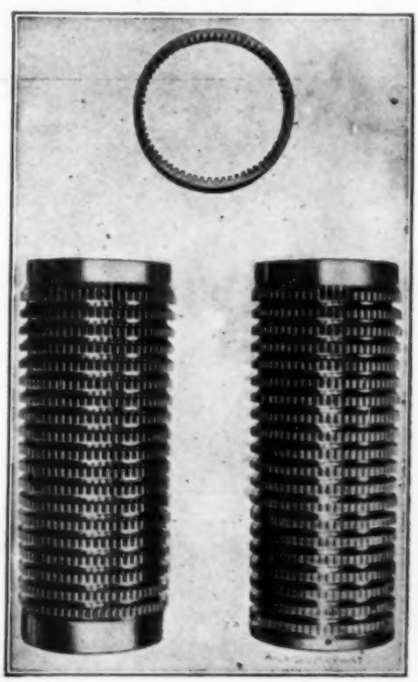


Fig. 10. Broaches for Internal Gears

it is mounted on a special fixture and centered from the teeth while being finished on the outside to insure the outside diameter being true with the teeth. This work is all handled in our broaching press, using lard oil as a cutting medium.

Milling Connecting Rod Brasses

EDITORIAL CORRESPONDENCE

The engravings illustrate some simple and efficient fixtures used by the Triumph Ice Machine Company, Cincinnati, Ohio,

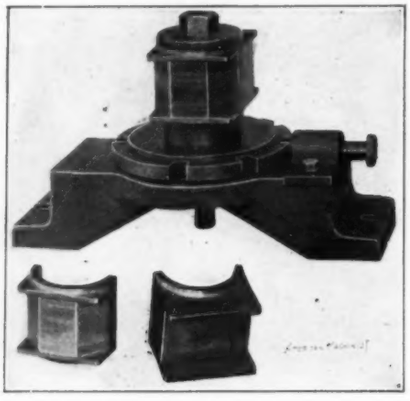


FIG. 1. INDEXING FIXTURE FOR MILLING CONNECTING-ROD BRASSES

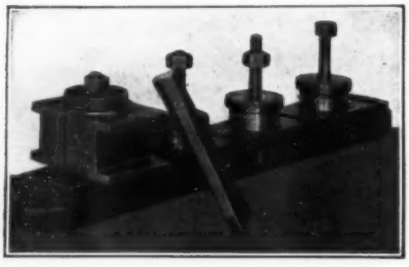


FIG. 2. FIXTURE FOR MILLING CONNECTING-ROD BRASSES

for milling the sides and edges of connecting-rod brasses.

AN INDEXING DEVICE

The indexing fixture in Fig. 1, is for the larger sizes of brasses made in rather small lots where a multiple holding appliance would present few if any advantages from a point of view of economy in manufacture.

This fixture has a vertical spindle passing down through the index plate and the base, with a nut on its lower end by which it may be firmly secured if so desired, at any point to which it is indexed. The index plate is divided to give positions for the milling of the faces around the two brasses, and the plate is locked at the different points by the spring-controlled plunger at the right-hand side of the fixture. One-half of the brass has three faces of a hexagon milled between its flanges, and the other brass has one angular side to correspond to the taper of the adjusting wedge in the rod end. These faces with the parallel sides of the brasses are finished by end- and face-mills.

The brasses are bored out and faced on the ends prior to placing upon this fixture and here they are held between a collar on the vertical stud and a large washer at the top. The clamping faces are sufficiently broad to hold the two pieces securely under the action of the cutter, and a smooth, accurate job is secured without difficulty.

A GANG FIXTURE

The fixture in Fig. 2 holds four pairs of brasses and in milling the parallel sides with a face cutter the table is adjusted until one side of the job is milled the right distance from the center as determined by measuring over the clamping collar and over a parallel placed against the work, as in Fig. 3, then the whole fixture is turned end for end on the milling-machine table and the other side of the work finished without altering the cross slots in the fixture and in setting the work square for the facing of surface *A*, a parallel is placed against the parallel edge of the device. After clamping the brasses, the setting wedge is slipped into the next slot of the fixture and the process repeated. With the four sets of brasses clamped in place, the right-angle face can be milled off, and then the work can be reset by the taper edge of the wedge which gives the correct position for the milling of the angular face *B*.

The brasses fit nicely over the locating

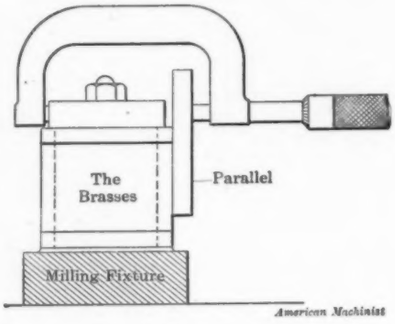


FIG. 3. TESTING ACCURACY OF MILLING CUT AND ITS DISTANCE FROM CENTER OF BRASSES

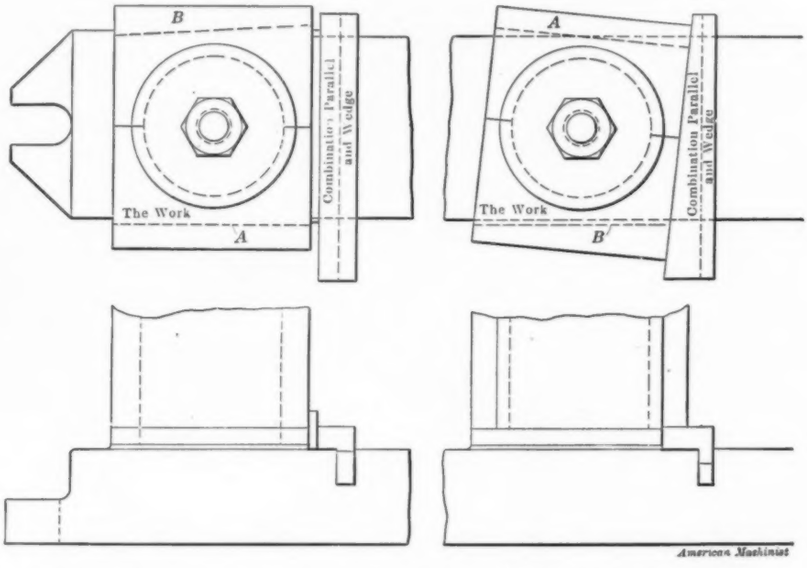


FIG. 4. TWO SETTINGS OF THE BRASSES FOR THE MILLING OPERATIONS

side adjustment of work of cutter. Thus the opposite faces of the brasses are machined equi-distant from the center of the bore.

In setting as in Fig. 2, for milling the surfaces between the flanges (for either the parallel surface of one-half of the brass, or the taper face of the other brass for the adjusting key) the brasses are located on the fixture by means of the combined parallel and wedge shown resting against the edge of the casting. A sketch of this member is given in Fig. 4, and its application will be clear from this illustration. It is slipped into one of the collars on the face of the fixtures, and the clamping collar at the top is provided with a reduced portion which fits closely in the bore of the work, the collar being free upon the stud.

Blanchard Vertical End Grinder

The diameter of the magnetic chuck on the Blanchard vertical end grinder is 24 inches instead of 36 inches as stated on page 1070, Volume 34. The capacity of the machine is 30 inches.

Increasing Output of Screw Machines

By S. N. Bacon

How an output increase of 80.5 per cent. was attained without increasing speeds.

I wish to illustrate in the following article that the proper design of tools and equipment in modern shop practice plays an important part in reducing production cost. Speeding up machines will often increase the production but sometimes it also increases the tool costs. There are hundreds of jobs running today on which the output could be doubled if the method of manufacture were up to date.

The No. 2 Brown & Sharpe automatic screw-machine job shown in Fig. 1 is being manufactured in quantities by a large electric company, the present rate of production being 80.5 per cent. gain over the old method and besides the work better in quality and the speeds and feeds used are not greater than with the old method.

Let us now consider the order of operations and the layout which was previously used on this piece. The method of setting the slide tools is shown in Fig. 2. At A is shown the cutoff tool and B is the form tool for the short shoulder, as it would have made the tool too wide to form successfully the three diameters.

The first bad feature noticed is feeding the stock to length, this being done because the turret is filled with tools. Of course a stop could have been placed in the turret instead of using two box tools, necessitating the use of a double box tool to cut the two shoulders, which would have given trouble.

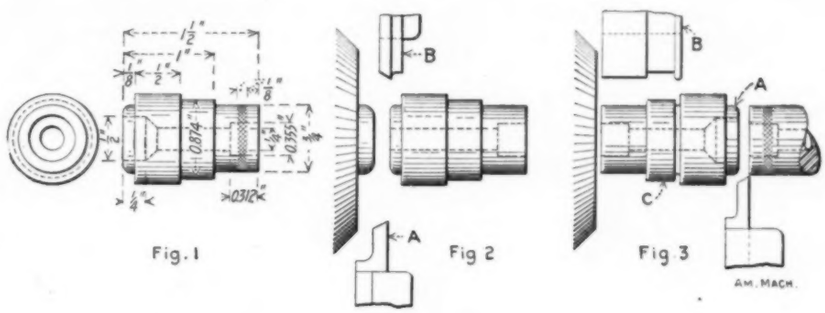
The order of operations for the old method is as follows:

ORDER OF OPERATIONS

Spindle Speed 277 and 640 R.p.m. Forward

	277 R.p.m.	640 R.p.m.	Hundredths
Feed stock to length		86	3
Center 0.190-inch travel travel at 0.0045-inch feed		72	2½
Revolve the turret		72	2½
Drill 0.825-inch travel at 0.0044-inch feed		187	6½
Revolve the truret		58	2
Drill 0.825-inch travel at 0.0044-inch feed		187	6½
Revolve the turret		72	2½
Counterbore 0.322-inch travel at 0.0056-inch feed		58	2
Revolve the turret		144	5
Box tool 0.885-inch travel at 0.0057-inch feed	156	360	12½
Revolve the turret		72	2½
Box tool, small shoulder, 0.510-inch travel, 0.0051-inch feed	100	230	8
Form 0.160-inch travel at at 0.0014-inch feed	113	260	9
Cut-off 0.550-inch travel at 0.0012-inch feed	442	1022	35½
Revolve the turret		72	2½
		2880	100

The second feature noticed in this layout is a very deep hole to be drilled, so deep in fact as to require cam surface to allow the drill to withdraw and be freed from chips when it returns to finish the hole. This with the two box tools makes the job a slow one. Those who are interested in laying out cams should remember that a slow job will waste more time than a fast one because the slower the cam revolves the greater the number of revolutions required to revolve the turret and feed the stock. This statement



THE WORK

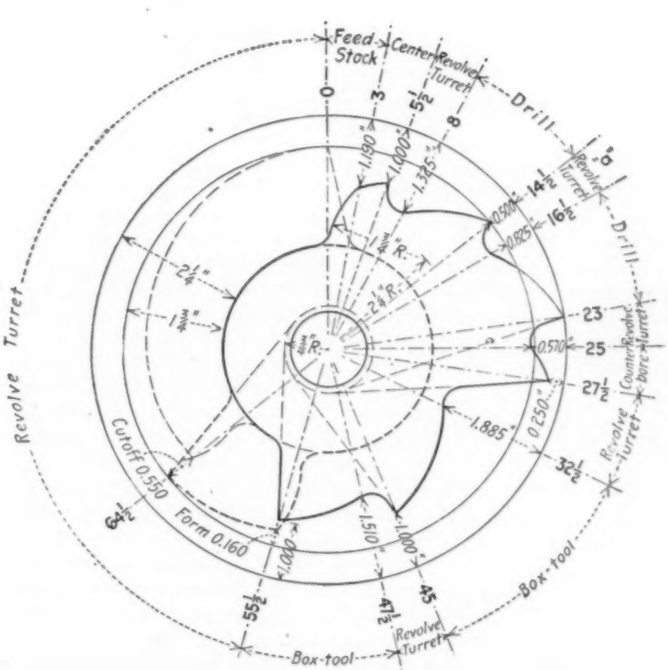


FIG. 4. THE FIRST CAM USED

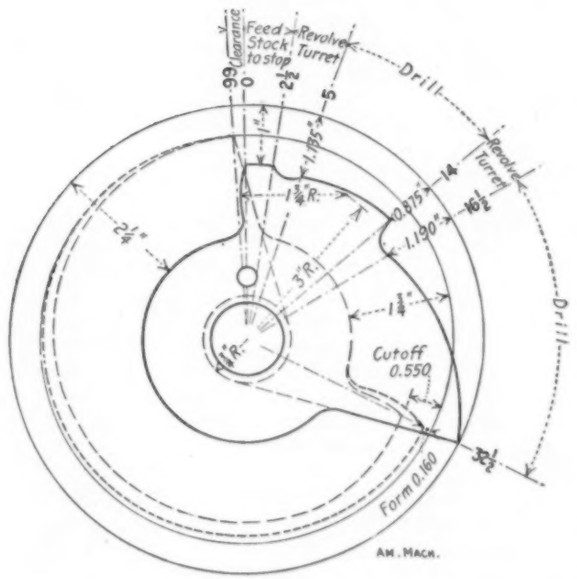


FIG. 5. THE CAM FINALLY USED

may sound queer as it is a well known fact that the faster the cam revolves the more cam surface required to feed stock and revolve turret, but the writer refers to layouts which require not more than three hundredths. This is because it always requires a minimum space of 3 hundredths of cam surface, no matter how slow the cam is turning. For instance, referring to the table for the No. 2 Brown & Sharpe machine for a 35-second job, we find it requires 3 hundredths of cam surface to feed the stock. This would equal 21 revolutions of the spindle (when using the fastest speed of the machine) but on a 180-second job we must use 108 revolutions to revolve the turret because sufficient cam space is required to allow the roll to drop below the start of the next cam lobe. As shown at 14½ to 16½, Fig. 4, a space of 2½ cam hundredths has been allowed but this could not be done when the lobe following has a long throw. So from this we understand why the long jobs on the No. 2 machine seem to have lost time. The cams for the old method are shown by Fig. 4.

In describing these cams I will explain why it required 5 hundredths of cam surface after counterboring when it only required 2½ for the other operations. In laying out the cams the high point of the lobe at 5½ hundredths on the cam was cut down 1 inch so as to be as low as possible to the point on the cam where the drill started to cut (8 hundredths on the circle). Thus it was possible to use only 2½ hundredths at 5½ to 8 and 14½ to 16½ and 23 to 25, but when we reach 27½ we are again at a high point before descending to a low one and to do this with the proper drop it requires 5 hundredths of cam as shown from 27½ to 32½. As the rest of the cam will be easily understood the writer will pass on to the improved method of making the piece.

The new layout of tools is seen at Fig. 3. The limits of the work did not require the small diameter A to be concentric with the other diameters but it was required that the length of the shoulders be held close. This is done better with the form tool B than with the two box tools, which depended on adjustment for length of each shoulder. The second advantage gained is relieving the large shoulder at C. This always gave trouble when made with a box tool as it left a round corner and the piece which revolved on this shoulder had to be countersunk to allow for this. The third advantage is that the work can now be fed to a stop, thus holding to close length, and another is that we now have the small counterbored hole next to the spindle and a Brown & Sharpe attachment may be used to make this light counterboring cut, which was formerly done on the hand-screw machine. This attachment is placed in the same position as the slotting attachment and the ½-inch hole in the other end of the piece need not be counterbored but can be cut with a drill. The fourth big gain in this layout is that the nurling is done with a tool fastened to the cutoff tool and in this way a hand-screw machine operation is done away with entirely. The new order of operations is as follows:

ORDER OF OPERATIONS

Spindle Speed 277 and 640 R.p.m. forward

	277 R.p.m.	640 R.p.m.	Hundredths
Feed stock to stop		40	2½
Revolve the turret		40	2½
Drill ¼-inch diameter 0.260-inch travel at 0.0042-inch feed	62	144	9
Revolve the turret		40	2½
Drill ¼-inch diameter 1.190-inch travel at 0.0049-inch feed		256	16
Cut-off 0.550-inch travel at 0.0012-inch feed	461	1064	66½
Clearance		16	1
Form 0.160-inch travel at 0.0004	461	(1064)	(66½)
Total number of revolutions to make one piece		1600	100

After studying the above operations it will be noticed that the increase is not only in doing away with the box tools but that the form tool may work while the finished piece is being cut off, saving a large amount of time. We also use a ½ drill for the first hole instead of a counterbore, which tool is not required, and by this we shorten the travel of the ¼-inch drill enough to allow it to finish the hole without backing out to free it from chips. Next is given a comparison of time, etc., of the two layouts.

Old cams required 270 seconds for one piece, new cams, 150 seconds.
Old cams, gross production 133 pieces; new cams, 240.
Old cams, net production, 120 pieces; new cams, 210.

Old gears, 36 driver.	New gears, 36 driver:
72 first on stud	80 first on stud
40 second on stud	40 second on stud
90 driven	90 driven

The gain in production is 240 pieces in 10 hours over 133 pieces in 10 hours or an increase of 80.5 per cent.

The new cams are shown at Fig. 5. They require very little explanation. The deep hole is drilled at 16½ to 32½ on the cam circle. In comparing the machine operations we have for the old method:

First operation, automatic screw machine.

Second operation, nurl and counterbore on hand screw machine.

New method: Piece finished complete on automatic screw machine.

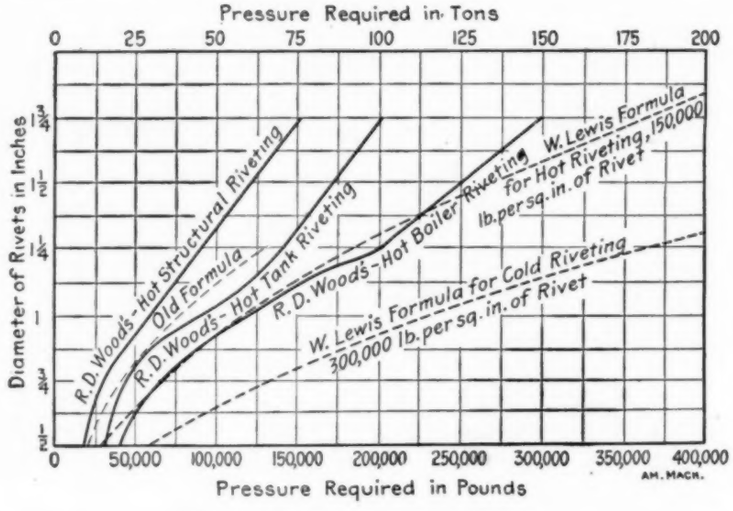
No inconvenience arose from using the cutoff tool so far from the spindle, as this is common practice on the large machine and works satisfactorily on large stock.

In comparing the feeds and speeds in both layouts it is seen that they are the same and that 80.5 per cent. increase has been made by superior methods alone.

Pressure Required to Drive Rivets

By W. T. Sears*

The accompanying chart was gotten up for the purpose of comparing the various formulas and tables, giving the pressures required to properly drive rivets. Considerable numbers of notebooks, catalogs, etc., were examined, but all that were found are practically covered by the curves shown on the chart.



Pressure Required to Drive Rivets

From personal experience on structural riveting, I should say that the tendency of late years has been to increase the pressure until the best practice at present brings the pressure curve nearer the Lewis formula for hot riveting than to the R. D. Wood formula for hot structural riveting.

The dotted line, marked "old formula," is one that was used a number of years ago by the Niles-Bement-Pond Company, for structural riveting. Modern practice is somewhat higher.

*Mechanical engineer, Niles-Bement-Pond Company, Philadelphia, Penn.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

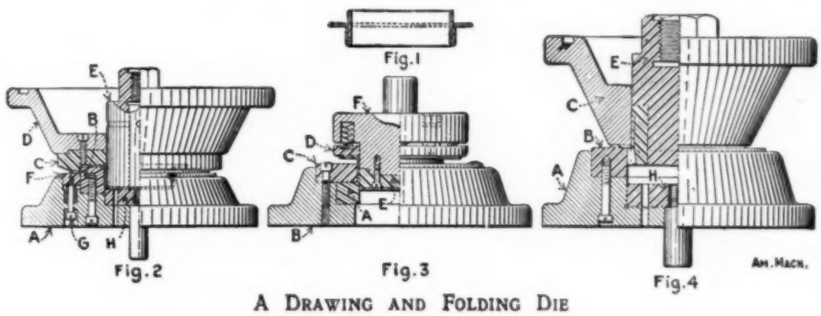
A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Drawing and Folding Die

Some months ago while visiting one of the sheet-metal working firms in Michigan I was shown the tools for producing the brass flanged ring shown in Fig. 1 and as the operations are such that they may be utilized for other articles of a similar nature, besides illustrating how easily a seemingly complicated part may be made, if the proper method is followed, they are described herewith.

The ring is of No. 22 Brown & Sharpe sheet brass, and is about six inches in diameter, and one inch deep, with a one-half-inch flange around it, as shown. As the two side walls are in contact with each other it would appear to be a very hard piece to produce.

The die for the first operation is shown in semi-section at Fig. 2 in which *A* is a cast-iron shoe bored out to receive the drawing die *B* which is secured to the shoe by fillister-head screws, and whose outer upper edge forms the blanking punch co-acting with the blanking die *C* which is seamed to the blank holder *D*, to cut the blank before drawing begins. Both these rings are of tool steel properly hardened and drawn, and it will be noted that the blanking die *C* after cutting, descends until the blank is clamped between itself and the upper surface of the drawing die *B*, in which position it dwells while the drawing plunger *E* descends and draws the tray-shaped shell. The scrap around the blank is held between the die *C* and a soft-steel stripper ring *F* which serves to clear the blanking punch *B* after the blank holder ascends. This ring is spring pressed upward by several springs and its travel is limited by the shouldered studs *G*. The blank-holder *D* is a casting and is machined to fit the press on which the rings are drawn, while it is bored out to guide the cast-iron drawing plunger *E*. It has been found that cast iron is entirely satisfactory for this purpose and the lower edges seem to hold up almost as well as a steel plunger would.



A Drawing and Folding Die

A "knock-out" plate is seen at *H* and is actuated by the stud which is screwed into same and is shown projecting below the die. Vent holes are drilled through the knockout plate and also through the die shoe to allow the air to escape while drawing instead of being compressed under the plunger. It may here be stated that the proper venting of drawing dies is largely contributory to their successful operation, although this detail of design is sadly neglected on many occasions. It will be further noticed that there are vent holes in the drawing plunger to allow air to enter when the plunger rises thus preventing buckling of the shell.

The second operation is that of blanking out the center of the shell, for which the die shown at Fig. 3 is used.

A tool-steel die ring *A* is set into the cast-iron shoe *B* into which it is clamped by the locating ring *C*, of soft steel, and which is screwed to the shoe. This construction permits easy removal of the disk for grinding and also eliminates the necessity of holes in the die while hardening.

The blanking punch *E* is a tool-steel disk screwed to the cast-iron punch carrier *F* which also carries the soft-steel pressure ring *D*. This ring is spring pressed downward by several helical springs and its travel is limited by shouldered studs in *F*.

The central portion of the shell is used for making other smaller parts. The ring now is placed in the die shown in Fig. 4 in an inverted position and located by disappearing stop pins. The tool-steel ring *B* screwed to the shoe *A* has a diameter inside equal to the ring neck diameter plus twice the thickness of the metal. A cast-iron blank holder *C* serves to hold the ring securely while the drawing plunger *E*, with the hardened-steel shouldered ring *D* shrunk on to its lower end, descends and backs the ring down into the ring *B*, an operation which the press operators call "skinning the cat." The lower end of the plunger is tapered to enter the ring easily and the press is timed so that this plunger has centralized the ring before the blank holder pinches it.

A knockout plate *F* serves to eject the finished ring from the die.

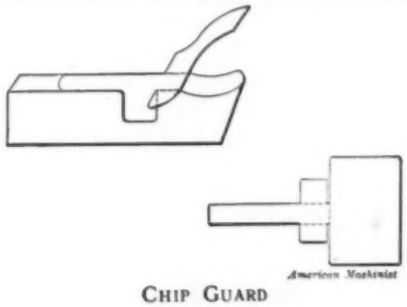
These dies must be well lubricated when in use as the service, especially in the latter die, is very severe and grooving of the drawing ring *B* will sometimes occur if the metals are allowed to get dry. The writer would suggest that in making this part, a trimming die be used to trim the outside of the shell to the proper diameter so that it will center easily in the last die, but in this case the shells are trimmed in a trimming lathe before the centers are blanked out.

Detroit, Mich. ARON LAWRENCE.

A Simple Chip Guard

The illustration shows a very simple chip guard, which I find extremely valuable in turning brass.

The guard is made of a piece of tin cut out to fit tool post, as shown, and bent over along dotted lines on sides and front. It is held in place by tightening tool-post screw.

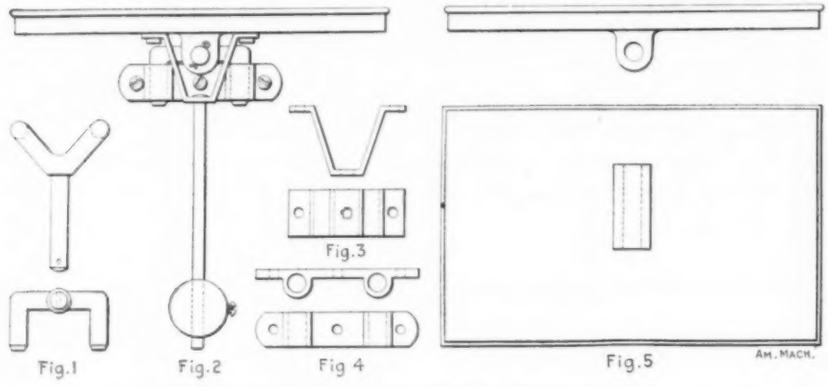


Chip Guard

Cincinnati, Ohio. M. WAGNER.

Self Balancing Tray for Tilting Drawing Board

A very neat and serviceable addition to the tilting drafting table is shown in Fig. 2, this being a self-balancing instrument tray. It is composed of very few parts: viz., tray, bracket, weight, swivel-fork and socket. The tray, Fig. 5, was made of galvanized iron 5x8 inches, with a small lug riveted on the bottom for the swivel fork to fit into, the hole being ⅜ inch diameter and 1½ inches long. This tray was lined inside with felt, thereby eliminating any danger of marring the instruments.



SELF-BALANCING TRAY FOR TILTING DRAWING BOARD

Fig. 1 shows the swivel fork, all three prongs being ⅜ inch diameter, the one for the tray being 2 inches long and having a small hole for a cotter pin. The other two prongs were ¾ inch long and 1¾ inches center to center, to fit into the socket fastened to the edge of the board. Fig. 4 shows this socket. It was fastened to the board with three 1½-inch, No. 12, round-head screws. Both Figs. 1 and 4 were brass castings.

Fig. 3 shows the bracket made out of a piece of ⅛x1-inch galvanized iron. This also was riveted to the under side of the tray; a ¼-inch brass rod was threaded and screwed into the bottom and the weight attached.

It will be noticed that no matter where the attachment is placed on the end of the board, it will always stay level regardless of the angle of the drawing board.

GEO. H. HANDLEY.

Newburgh, N. Y.

The Practical Use of a Novel Indicator

The indicator I constructed is a simple and extremely sensitive surface gage, to be used mostly for centering scales that are to be graduated on the new graduating engine built by the Department of Physics, University of California.

The indicator has a light steel lever *B*, Fig. 1, mounted in hardened-steel bearings or pivots *D D*, and carries the contact point *A* at a distance of ¼ inch from the line of bearing. The other end of the lever engages with a mirror *C* about 1 inch square, which is mounted to rotate on jeweled bearings *F F*. The mirror can be shifted by the support *H*, so that the end of the steel lever *B* will touch the mirror at a distance of from ⅛ inch to ½ inch from the axis of rotation. All these adjustments enable the operator to reflect an image from the mirror to a scale in any part of the room desired.

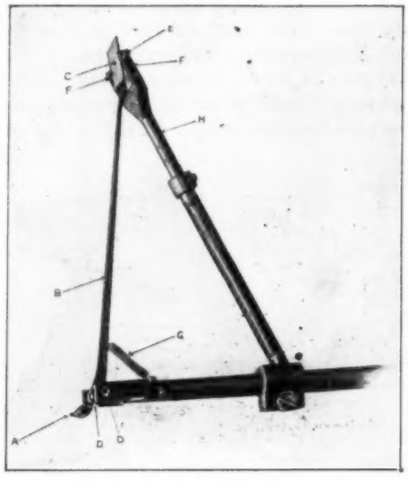


FIG. 1. THE INDICATOR

THE OPERATION OF THE INDICATOR

An incandescent lamp is set at a distance of about 4 feet from the mirror *C*, and the light from the lamp is passed through an ordinary lens to the mirror. The light is reflected to the scale on the wall about 10 or 15 feet away, and the lens is moved backward or forward until a clear image of a straight part of the lamp filament is produced, in other words, until it is focused.

As used, an eccentricity or variation of one ten-thousandth part of an inch produces a motion of the image of about 20 inches on the scale on the wall.

The contact point *A* is kept against the work to be tested by the extended spiral spring *G*, and the mirror is kept against the end of the lever by a light spring *F*.

I consider the instrument considerably more sensitive than any other, because I have eliminated all side friction; whereas, all dial gages have not in their construction this advantage.

Fig. 2 shows the indicator in use on the dividing engine in the act of correcting the eccentricity of the taper-hole, which is used for the arbors on which the scales are mounted. The periphery of the scale is made true and as accurate as possible at the same time as the silvered surface is faced. For this purpose a piece of brass is turned in the chuck to fit the hole in the scale. The scale is then put in position on the arbor, which is about one-thousandth smaller than the hole to give it play for the adjustment. The worm in the dividing engine is then disengaged to permit the workmen to revolve the gear wheel on the engine; this enables him to proceed with the centering of the scale.

OSWALD G. STEINITZ.

Berkeley, Cal.

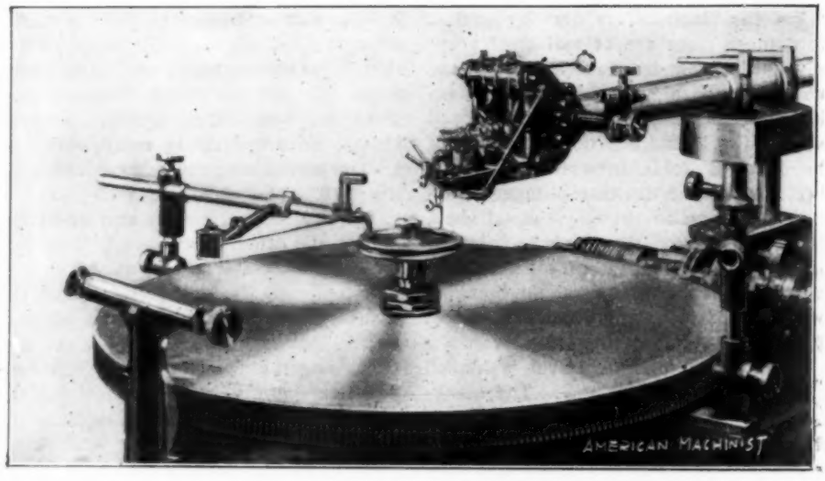
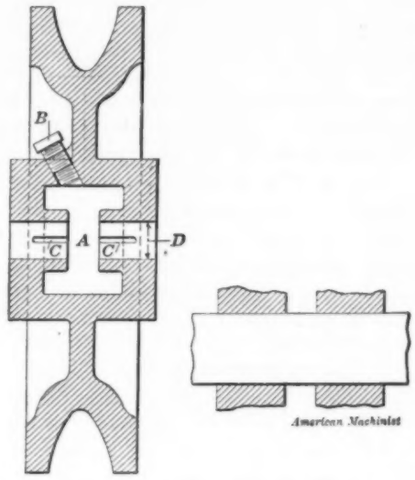


FIG. 2. THE INDICATOR IN USE ON THE DIVIDING ENGINE BUILT AT THE UNIVERSITY OF CALIFORNIA

Loose Sheave Oiling

In the accompanying illustration, I am showing a very simple and efficient means of lubricating a loose chain sheave, which is in constant use and difficult to get at; for instance, at the upper end of a crane on a steam shovel, and, therefore, must have sufficient lubricant to keep it well oiled for a few days.

In the cut *A* represents a cored cavity in the hub *D*, and holds the grease or



DEVICE FOR LOOSE-SHEAVE OILING

other lubricant. *B* is a threaded plug which serves to close the hole through which the cavity *A* is filled.

C and *C* are two small grooves cut in the hub to feed the grease to all parts of the bearing. This method of oiling will be found more economical than that of using a compression grease cup and there are no caps to fly off. Sheaves run in this manner will not run dry for days, and will need very little attention. This method, I believe, might also be used on loose pulleys and give equally satisfactory results.

EDWARD SOBOLEWSKI.

Cincinnati, Ohio.

Helical Spring Coiling and Cutting Machines

The two devices shown in the cut were designed for the rapid production of small helical compression springs such as are used in door locks to operate the pin tumblers, and while no effort was made to produce automatic or complicated machines, the results obtained from these are extremely satisfactory.

The coiling machine is shown at Fig. 1, in which *A* is a cast-iron frame the upper portion of which forms the bearings of the driving shaft *R* and the upper feed-roll shaft *P*. The driving pulley *M* and the pinion *N* are pinned to the end of the shaft *R* and the pinion meshes with the upper gear *S* on the feed-roll shaft *P*. This shaft carries at its front end the upper feed roll *E* of hardened tool steel. This roller *E* is keyed to its shaft as is the lower one and held in place by the hex nut as shown. The lower feed roll is carried on the shaft *D* which runs in the swinging arm *B* rocking about the shaft *C* as a pivot.

A gear *S* on the shaft *D* meshing with the gear on shaft *P* serves to drive the feed rollers.

A steel rod *F* provided at its upper extremity with a bar handle and screwing into the swinging arm *B* at its lower end serves to adjust the feed roll tension by the compression given the rubber bumper *G*.

The wire enters the feed rolls from the left and passes into the tool-steel guide

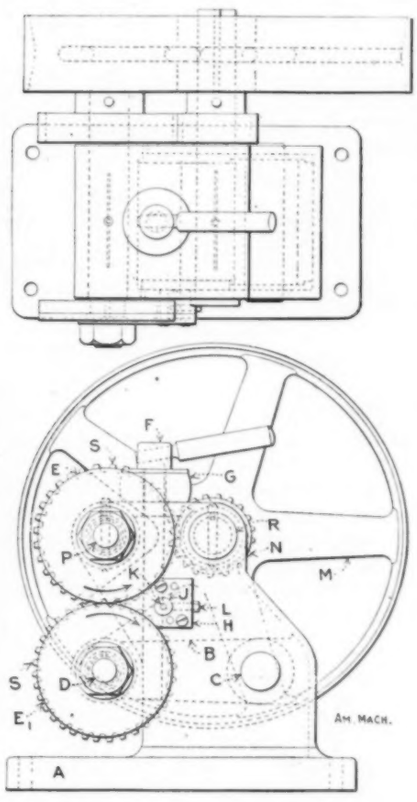


FIG. 1. COILING MACHINE

block *H* through a hole just large enough to clear the wire and then into the curling bushing *J* which is made of tool steel, glass hard, to withstand the wear of the wire taking its initial bend. A hardened-steel spacing rod with an offset on its forward end at *K* serves to give the spring the proper pitch in coiling. The feed rolls are marked with a shallow V groove to guide the entering wire. As the wire cannot go anywhere except into the curling bushing it curls into the spring helix and emerges from the front end of the tube and enters a long piece of pipe mounted on a post on the same bench with the coiling machine. The pipe may be about six feet long and at the right-hand end of it is located the cutting machine shown in Fig. 2.

The base of this device *A* is of cast iron and carries the driving shaft *B* with its pulley *C* and pinion *D* which meshes with gear *E* on the cutter shaft *F*.

The cutter disk *G* is a hardened tool-steel star wheel the points of which are spaced at a distance apart equal to the desired length of the spring and the edges are sharpened to a cutting chisel edge. A guide plate *H* mounted on the face of the base casting *A* with screws and dowels keeps the spring in contact with the cutter wheel. A hardened tool-steel roller *J* mounted on the eccentric post *K* is adjusted to contact with the points of the cutter disk *G* and every time the cutter revolves as many springs are cut off as there are teeth in the cutter disk. The cut springs fall down into a tray placed to receive them. The two machines are so belted up that the cutting machine runs about 50 per cent. faster than the coiling machine, and they are operated as follows: After the coiled spring enters the long pipe and emerges from the right-hand end, the coiling machine tension lever is turned, thus causing the feed rolls to slip on the wire and in consequence the spring coiling ceases temporarily.

The operator now cuts the spring off at the left-hand end close to the coiling machine and enters the right-hand end of it into the cutting machine, at the same time tightening the roll tension lever on the coiling machine which starts coiling another length. Owing to the cutting section making faster time than the coiling

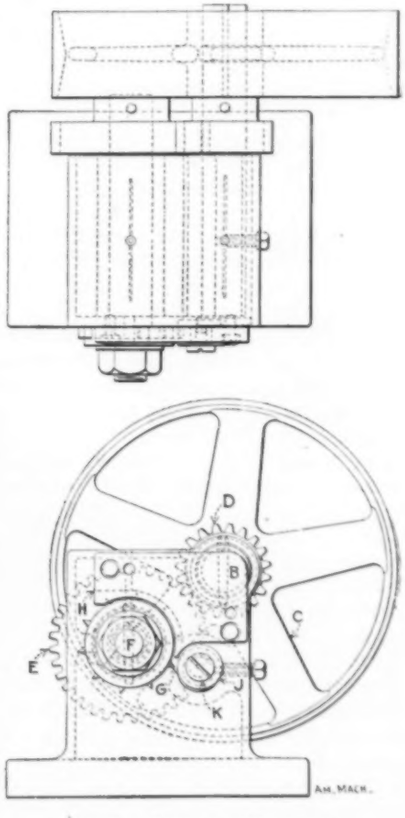


FIG. 2. CUTTING MACHINE

section there is no danger of the two springs getting tangled in the pipe.

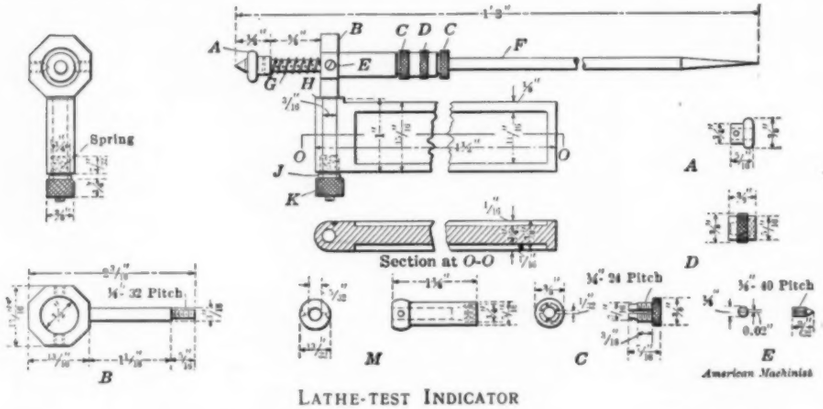
The cost of these devices is very little and they can be fitted up to curl a wide range of springs both open and closed coil.

Detroit, Mich. ARON LAWRENCE.

Lathe Test Indicator

This lathe-test indicator is for use in setting centrally any point or hole in a piece of work to be operated upon in a lathe or upon a face plate.

At *A* is shown device for centering the hole, and when in use the rod *F* is locked in *M* by screwing up nut *C*.



LATHE-TEST INDICATOR

When using 60-degree end of rod *F* for centering up point made with center punch, rod *F* is loose in *M*, so that the spiral spring *G* will hold finger against the work with an even pressure. Lock nut *D* is for keeping rod *F* from slipping out when indicator is not in use.

B is held in *L* with nut *K*. At *J* and *H* are washers to eliminate friction. The spiral spring in recess holds *B* evenly; *K* screws up to shoulder and there is no binding. Part *A* is pinned to *F*.

The screws *E* hold *M* in position, and a tight fit is necessary, so that they will hold when adjustment has taken place. The angle at point is 60 degrees.

The bar of the indicator *L* is made of such a size as to be held conveniently in the tool post of a lathe. All wearing parts are to be carefully hardened and ground.

New Haven, Conn. JOHN R. JARVIS.

Method of Boring Castings

Many mechanics who have laid out a job of the kind shown in cut, have probably found it is very tedious to transfer the center line of the bore to the outside so as to be able to drill a hole absolutely true. Fig. 1 represents a casting of which we had several to machine, but not enough to go to the expense of making an elaborate jig.

The specification called for a butterfly valve to be fitted into the 3-inch bore; the disk was to be a snug fit, and had to be turned through an angle of 180 degrees without binding. The specifications also demanded that the distance from the center line to the face of the flange was to be the same in all castings, and the stem had to be square with the bottom face. This called for extreme accuracy and as the outside of the castings were quite rough, the difficulty was greatly increased.

Fig. 3 shows a simple plan I devised for doing this job.

The disk *A*, was roughly cut out of a piece of 3/16-inch sheet steel; a hole was drilled through the center and a hardened bushing *B*, having a hole the size of the drill, driven in to it.

The disk, with its bushing, was then placed on a mandrel and turned to the exact diameter of the 3-inch bore, and the circumference of the disk was turned to the radius of the bore so that it could be inserted into the bore edgewise.

At *C* is a piece of 1x¼-inch cold-rolled hardened steel with a ⅜-inch hole drilled through one end.

A piece of ⅜-inch drill rod *D* was placed in the drill chuck and perfectly centered; the disk *A* slipped on and allowed to rest upon a parallel block on the driller table. In order to have the right hight a piece of 1/32-inch sheet steel was placed between the disk and parallel block, and the latter located the right distance from the drill rod by means of the piece of cold-rolled steel *E* with the hole drilled the right distance from its edge. The upper parallel block was then laid upon the disk *A* and, to keep it from canting, a piece of 3/16-inch steel *F* was placed under the opposite edge and the upper block carefully squared with the lower one, the drill rod withdrawn, *C* slipped on and the whole strapped down by the planer strap *G*.

The drill is now inserted into the chuck and the castings slipped onto the disk *A* with the face *H*, Fig. 1, resting upon the drill table and the face of the flange against the parallel blocks. An iron wedge with an easy taper was slipped under the flange at *I* to prevent the casting from tipping under the drill pressure. *C* guides the drill for the upper and bushing, *B* for the lower hole.

The time required for the preparation of the fixtures and the drilling was less than it took to lay out ten of the castings, there being twenty altogether.

We have since used the same scheme on tubes to be fitted with butterfly valves with equally good results.

In this case the hole was four inches from the end of the tube and we made the bushing *B* long enough to extend into a hole drilled through a piece of flat stock *J*, Fig. 2, which acted as an arm to carry the disk.

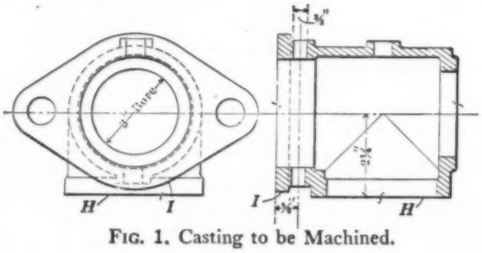


FIG. 1. Casting to be Machined.

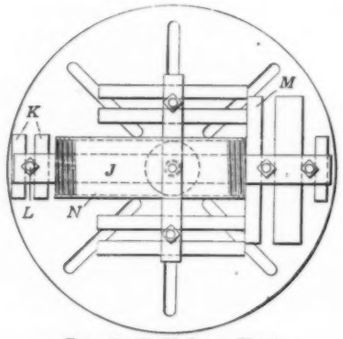


FIG. 2. Drill Press Table with Rigging in Position.

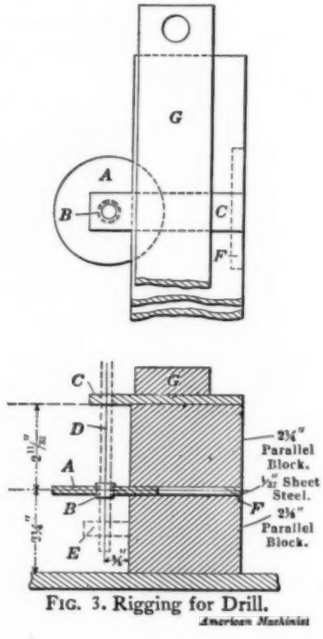


FIG. 3. Rigging for Drill.

METHOD OF BORING CASTINGS

The round disk being turned off on a mandrel, of course, brings the hole concentric with its circumference.

Fig. 2 is a plan view of the driller table with the rigging in position. The blocks *K* and belt *L* were removed, the tube slipped on against the block *M* which acts as a stop and *K* and *L* replaced.

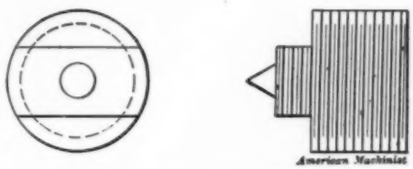
V-blocks were slipped under the tube *N* and it was ready for drilling. We have found that placing the tube on V-blocks and centering by the outside made the job worthless, due to the variation in thickness of the tube walls.

New York City. H. E. A. RAABE.

Transfer Studs for Toolmakers

The illustration shows a hardened tool-steel stud to be made in sets as per table, which toolmakers and machinists will find very valuable.

Frequently it is desirable to tap a "blind hole" in a hardened-steel part, for the sake of appearance or to prevent the accumulation of dirt and chips in jig or die work; but the fact that the piece will shrink or warp in hardening and so prevent the screw entering freely, causes the toolmaker to drill clear through with his tap drill in order to have a chance to transfer back to the casting, or soft-steel part after hardening.



TRANSFER STUDS FOR TOOLMAKERS

Dowel-pin holes can usually be drilled through, as the dowel pin can be driven in and ground off flush, thus offering no place for chips or dirt to collect; but with screws it is different, for it is impossible to grind them off flush, due to the intersection of the thread at some point leaving a gap.

By drilling and tapping the piece before hardening and at the same time drilling the dowel holes, the studs here described may be screwed in, after hardening, with the point outward, until just the conical point projects beyond the surface and the steel piece clamped in position. This will cause the conical spurs to center mark the casting, and while clamped in this manner the dowel holes may be transferred and an accurate job will be the result.

A	B	C	D	E	Remarks
¼–32	¼	7/32	3/16	7/32	Hardened
¼–24	7/32	7/32	3/16	7/32	Hardened
5/16–18	11/32	9/32	7/32	9/32	Hardened
5/16–16	11/32	9/32	7/32	9/32	Hardened
3/8–16	13/32	11/32	9/32	11/32	Hardened
7/16–14	15/32	13/32	11/32	13/32	Hardened
½–13	17/32	15/32	13/32	15/32	Hardened

DIMENSIONS OF TRANSFER STUDS

The studs are flattened on the spur end to facilitate their being screwed in or out, although narrow screw-driver slots on each side of the spur may be used instead.

There are many uses which will suggest themselves for these simple little studs and they are cheap and easily made.

Detroit, Mich. LAWRENCE RONA.

Proposed Wedge for a Bolt Header

The wedge marked W is one frequently found in cold bolt-heading machines for adjusting the punch to the required pressure on the die.

When the clutch is thrown out to stop the machine the momentum of the heavy flywheel carries the machine over for several revolutions, and unless a brake is used it usually stops on the center.

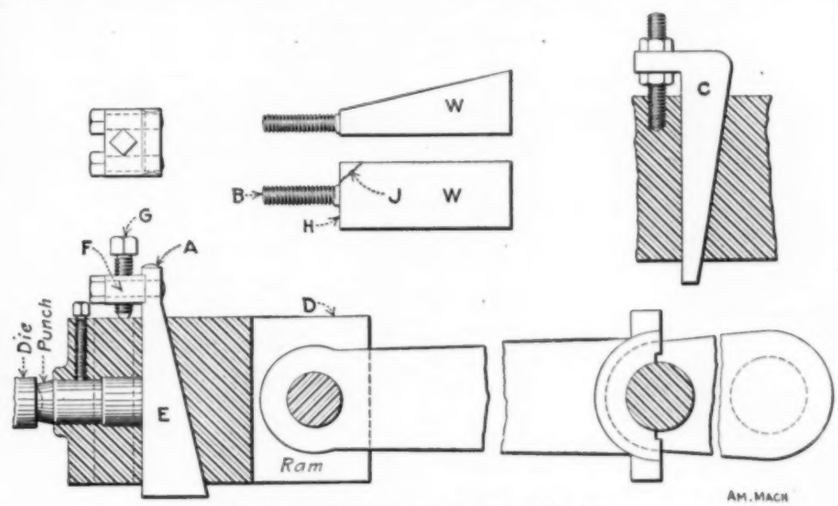
In case of a double head it sometimes jams with such force that a dozen men with a long bar to pry between the frame of the machine and a spoke of the flywheel cannot move the shaft. A blow with a sledge on the point *H* will start the wedge and release the machine. In striking the blows the stem *B* sometimes receives a glancing blow and is broken off. A hole is drilled in the wedge, tapped and a new stem screwed in only to be broken again later.

Sometimes a corner of the wedge is broken off as shown by the ragged line at *J* and a new forging must be made and machined. As they are made of tool steel, this is rather an expensive proposition.

Other makers put the big end of the wedge on top of the ram as shown by the dotted wedge at *C*. This is more troublesome still as we cannot strike the wedge from the under side of the machine and the operator hammers the surface *D* in his efforts to free the machine.

To overcome these defects I suggested the wedge shown at *E*. The piece *F* is bolted to the front of the wedge *E* and carries the setscrew *G* for raising and lowering the wedge. This leaves the top of the wedge free to use the hammer at any time and for strenuous work the setscrew *G* may be removed and a sledge used with very little danger of breakage.

Brooklyn, N. Y. RICHARD ANDREWS.



PROPOSED WEDGE FOR A BOLT HEADER

Homemade Standard Tools

On page 702, Walter G. Groocock, in the course of some interesting remarks respecting homemade tools, states that an advantage to be derived from making milling cutters at home is that the tool room can remake them when worn, and thus effect a saving in steel.

A few days ago I discussed the question of recutting milling cutters with the foreman toolmaker of a large concern, which runs thousands of cutters constantly.

He informed me that they had now ceased to recut them. The chief reasons were that true economy consists in making the cutter as small as possible in the first instance and save on the first cost of steel; further, years of experience have shown that the average number of perfectly satisfactory cutters obtained from recutting is about 50 per cent., and that the labor put upon the wasters far exceeds the value of steel in the good cutters. Now that automatic cutter-grinding machines can be purchased, milling cutters might have their gashes deepened by grinding and this can best be done at each resharpening of the cutter tooth. The efficiency of the cutter throughout its entire working life would be increased by this method, for the "landing" could be kept always of correct width and not allowed to become four to six times as wide as it should

be. I should be interested to hear what Mr. Groocock thinks of this suggestion, and his experience on the proportion of wasters in recutting.

Glasgow. ROBERT SHAW.

An Easily Made Drill Chuck

The capacity of this chuck is only from No. 60 to about No. 40, although it could have been larger for use with drills up to No. 1.

A piece of steel shafting was placed in a chuck and one end bored to fit the end of a drill spindle, Fig. 1. The screw *A*

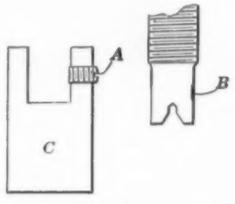


FIG. 1

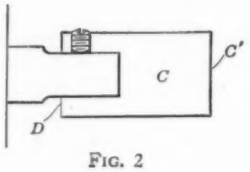


FIG. 2

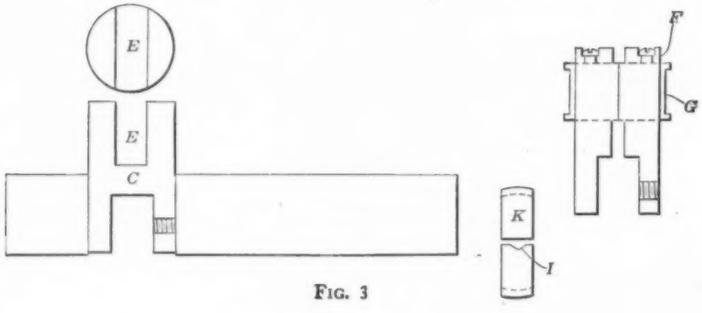


FIG. 3

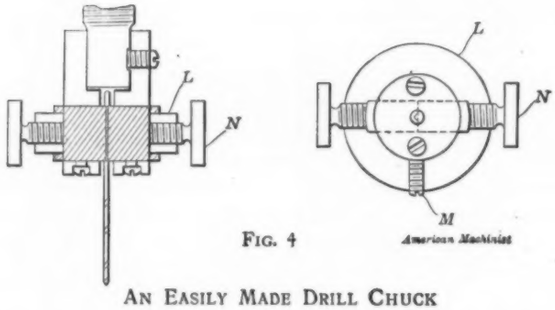


FIG. 4

AN EASILY MADE DRILL CHUCK

was provided to screw up on a flat surface *B*, filed on the drill spindle.

The end of a round, short piece was turned to fit tight in the hole *D*, Fig. 2; by means of this the chuck shell *C* was held, and the outside of it was turned true and concentric with hole *D*. The end of piece *C* was also squared up on the face *C'*, Fig. 2.

A flat piece, or fixture, with a hole bored to fit tight on the outside of piece *C* was used to hold it true while a slot like *E E*, Fig. 3, was being cut in the other end of it. A round plate, held with two screws *F*, Fig. 3, was fitted over the jaws. A hole was made in the center of this plate to permit the use of the largest drill mentioned above.

Two pieces of soft iron, roughly shaped for length, were fitted tight to the slot *E* to form the jaws. The jaws were placed tight in the slot *E*, the piece *C* was placed on the mandrel again, Fig. 2, and the outside *G* of the jaws finished; the faces of the jaws were squared and the outside of the jaws was shaped like *G*, Fig. 3, by turning in the lathe. The jaws were removed and scraped to make them slide freely in the slot *E*. A V-groove *I*, Fig. 3, was cut in only one of the jaws; the other was left with a flat face like *K*. This slot *I* can be adjusted afterward and made straight by hand scraping or filing, if the milling is not true.

The two jaws were placed in *C*; a drill was placed in the jaws while *C* was on the mandrel, Fig. 2; the jaws were held in place by screwing on the plate *F*, and the drill was tried to see if it would run true. The drill was slightly out, and was brought over to the center line of the chuck by scraping one side of the slot.

Fig. 4 represents the complete chuck. *L L* is a ring of such a thickness as to fit easily in the part *G* of the jaws, Fig. 3. A screw *M*, Fig. 4, holds the ring on the chuck and also takes up the lost side motion of the jaws to some slight extent.

After the jaws have been fitted to run a drill true, they are removed, placed in a small cup (preferably porcelain), and, with the addition of a small lump of cyanide of potash, heated to a red heat, gently, in a forge, for 10 or 15 minutes, until sufficiently case hardened. The screws *N N*, Fig. 4, or the whole chuck, could be case hardened also.

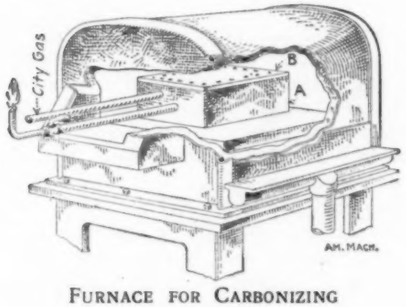
As it was desirable to have the screws *N N* fit tight, the threaded holes for these screws were tapped first and the threads cut on the screws in the lathe to exact size; hence, the screws worked smoothly and without lost motion. There is no provision for opening the jaws except by a side pressure of the drill shank when the drill is being removed. Of course, two motions are required in this chuck, instead of only one, to tighten the jaws on the drill, and the jaws are not self-centering; still, this involves little trouble and it takes but a few moments to adjust and center the drill.

Port Clinton, Ohio. S. E. FREW.

A Method of Carbonizing Small Pieces

The cut shows an arrangement used in connection with a method of carbonizing small pieces which are difficult to pack. This method eliminates the clumsy, tedious and messy job of packing small articles in bone dust or other like carbonizing material.

The box *A* is of cast iron, fitted with a cover *B*, which can be screwed down gas tight. At the top and bottom is a connection for a ¼-inch gas pipe.



FURNACE FOR CARBONIZING

Place a little old charcoal on the bottom of the box, and pack the box nearly full of parts to be carbonized and screw the cover down tight. The top gas-pipe connection is attached to the city gas line and the lower to a tip or burner. These pipes project through the doors of the furnace. The gas is turned on and lighted, and the box and contents brought up to carbonizing heat in the furnace. The carbon in the gas will rapidly combine with low-carbon iron or steel.

Philadelphia, Penn. J. H. HARRIS.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Cast Iron Boxes and Taper Gibs

Referring to John A. Sweet's article on page 893, Volume 34, we have to say that we are unqualifiedly in favor of cast-iron bushings in our line of work. We do not say that they are better in all cases, as we have learned that "circumstances alter cases," not only in the use of materials, but also in the design of parts. As far as we know, the Queen City Machine Tool Company, Cincinnati, Ohio, was the first builder to use cast-iron bushing in shaper work; this was in 1903. We found the drilling of these holes in line was practically impossible, a much better job being obtained by boring out large holes and fitting bushes, this also provided the means for renewing original centers. At first ordinary machine-steel shafts were used, but it was found that with the use of high-speed steel tools these shafts would twist under extremely heavy cuts, so a high-grade spindle steel was substituted.

But with all the care we could take, complaints would come of bearings running hot and cutting, so we decided to leave no excuse for the user if there was any trouble in regard to the oiling. The following practice has now been evolved up to the present shapers we are building in our shop, and while we believe it is pretty nearly the last word on shaper bearings, we solicit any practical suggestions for betterment.

A special quality of steel is now used in our shafts; it is very tough and is surface hardened. These shafts are ground to size and show a surface very different from that secured when ground soft. The column holes are all bored with a box jig, the truth of the holes being tested and the boring bar doubly supported and driven through a knuckle joint. The hole is then finished with a double reamer.

The cast-iron bushings are ground to a press fit in these holes, and they are also finished with a double reamer. These bushings have channels for carrying the oil to all parts of the bearing and an oil reservoir in which a ring is suspended to throw a copious supply of oil to the shaft. On account of the slow speed at which the crank pin runs, often as low as 6 revolutions per minute, a chain is used to carry the oil instead of the ring, as explained above. There is also a hardened bush on the bull-wheel hub, which is ground in place and fitted to a heavy bushing that is a press fit in the column. Here a chain oiler is also used, as the revolutions per minute are the same as the crank pin, and a ring would not supply the necessary oil for good lubrication.

Besides a ring or chain for carrying the oil up, the bushings have circular channels cut just within each outside edge and these are connected at the top by a channel. The ring oiler is central in the bearing with a reservoir for oil in the bottom of the bush. The ring lifts the oil to the top of the shaft, the oil following the channel in the top of bush to the channels in the ends. A hole is drilled from the outside end of the bush, parallel to the shaft, connecting the two end channels with the reservoir and leaving the bottom of the bush solid, but providing for returning the oil to the reservoir. This hole is tapped on the end and plugged with a headless setscrew to provide means for cleaning out the bearing when oil becomes dirty.

This is to call attention to what we consider better practice than that referred to by Mr. Sweet. It has been proved that grooving the shaft is bad practice where the speed is high or where the pressure is heavy. It is questionable if it is ever good practice, our opinion being that the ring oiler furnishing a copious supply of oil is the real efficient point and not the grooved shaft. We know that one of the largest concerns here in Cincinnati has tried the grooved shafts on planer change-gear shafts and lathe spindles, and found it very bad practice, it being impossible to keep the oil in the bearings. In our own case where shafts are hardened it would be practically impossible to use the grooved shaft. We have learned to have great respect for Mr. Sweet's opinions on matters mechanical, and merely wish to bring this question to his attention in a different light, so as to warn other manufacturers against trying experiments that might be costly and fruitless.

While on this subject of bearings, our experience with taper gibs may be of interest. We do not believe in taper gibs on planer or shaper heads nor in the ram or saddle of a shaper. We are willing to take the consensus of opinions from practical planer hands on the question of a taper gib on a planer head, for instance. We have three planers with straight gibs in the heads, and another make with taper gibs. The last planer is just as good in every way as the other three, but we cannot take up the wear on the heads, while we have no trouble on the others. The wear on these taper gibs is all at one end, where the pressure is exerted, and this is always the thin end. It will not wear evenly, as anyone can see by giving the matter a little thought. It is a very hard matter for the average shop to plane and scrape in a taper gib, but it is easy to replace a straight one, and this would mean a realinement of the bearing. We do not doubt that a taper gib is the proper thing in some cases, but it would be well to consider the duty it has to perform before accepting it as best practice always, as many writers seem to do. We know of manufacturers who are using taper gibs on planers and shapers as noted above, who are doing so against their own good judgment, because there is a popular demand for taper gibs at present. We believe this will soon change back to the best gib for the particular purpose it has to perform.

A. M. WATCHER,
Secretary and Treasurer,
Queen City Machine Tool Company.
Cincinnati, Ohio.

The Use of Dowel Pins

The suggestion of J. C. P. Bode on page 845 that it is well to have a few well defined rules for the proper use and placing of dowel pins in work, is a point well taken and I wish to supplement his suggestions with a few more.

Mr. Bode deals only with straight pins while, as a matter of fact, much of the trouble arising from the use of straight pins can be eliminated by the use of standard taper pins.

In reaming holes for taper pins it is a good custom, when the holes have been reamed to the desired depth, to part the two pieces of work and then give the holes in the lower part of the work about one or two more turns of the reamer—or enough to prevent the pins being as tight in this as in the upper part. This greatly facilitates parting the work as occasions arise.

Dowel pins should always be placed as near the outer edges of the work as possible. Failure to observe this not only

gives greater chance of error in the primary object of pinning the work together, but frequently it is the real cause of the pins shearing off. This is especially so when there is a twisting strain between the parts pinned together. It is indeed surprising to see sometimes how this point is disregarded.

When a pin is accidentally sheared off, leaving the point in a blind hole, it can be easily dislodged by drilling a ¼- or ⅜-inch hole—depending upon the size of the pin—at right angles to the pin, into the cavity back of the point of the pin. Then, filling the drilled hole about half full of oil, take a piece of drill rod the size of the drilled hole; place this in on top of the oil and hit it a sharp blow on the end with a hammer. The sheared-off pin is easily ejected by the principle of hydraulics.

As taper pins are of standard dimensions, with corresponding taper reamers made for that particular use, and as a taper pin is a drive fit in the reamed hole when put in to stay, I much prefer to use them for dowel pins when possible, rather than straight pins which are much more troublesome in getting a good fit and in their removal when necessary.

Proper dowel pinning is, as Mr. Bode suggests, a question which should receive more attention in the shop, and I believe that where dowel pins are necessary instructions based on the principles of correct usage should be given as to the kind, size and location of such pins.

Zanesville, Ohio. H. R. G.

On Perforating Sheets

In the AMERICAN MACHINIST, page 747, there appears a query: "How would you perforate these sheets?" To the equipment, as detailed by the querist, I should add a strong spring stripper, one that clamps the work to the die a little in advance of the punches. With this equipment, I should then expect to do good work. Now, a few pointers to the querist:

For a job of this description, the press must be in good order and have but a short stroke. It often happens that a press installed for some other product is used; but in this case, a machine should be obtained special to the job in hand.

In hardening the punches, it must be borne in mind that they have to stand almost as great a tensile stress in stripping as the compressive stress in piercing. They should be hardened in oil, and special attention must be paid to both hardening and tempering.

For punching thick metal, the punches need not be too exact a fit with the holes in the die. In the case under discussion, I should make the holes 0.003 inch larger than the punches. Also, the holes should be opened out at the back with a larger drill, so as to leave a thickness of about 0.125 on the top side, and this should be reamed out with a reamer of 3 to 5 degrees included angle. Many toolmakers use a reamer of 2 degrees included angle, but this is not sufficient. Since, in piercing small holes in thick metal, it is found that the metal, at the moment it receives the impact of the punches, is compressed, and, that the moment it enters the hole in the die, it expands again and fills the hole in the die very tightly, it will be seen that at the next stroke of the press, the punch must not only pierce another hole in the metal, but also force out the piercing from the previous stroke. As an illustration: I have found in piercing metal when the hole has been reamed with too slight a taper that, by reason of the expansion of the piercings, as many as four piercings have been held in the die; this is very much too hard for small punches.

The querist will find it advantageous in another direction also, to make the holes in the die a little larger than the punches. Owing to the closeness of the holes, the metal between the holes is compressed laterally; that is, when the punches strike the metal, they compress it before piercing it. This makes the work harder on the punches.

For work of this description, the dies must be ground perfectly parallel after hardening, the punches must be all of one exact length, the feed must be adjusted accurately, and the machine itself should have its slides adjusted with the greatest care. Attention to these details should lessen the questioner's trouble and increase his output. By the way, does his automatic feed release itself before the blow, as it should do? The slightest error here means a great deal.

GEORGE W. SMITH.

Birmingham, England.

Making Tracing Cloth Bite

At page 772, under the above heading, A. E. Lowe asks for the experience of other draftsmen.

It is not so much a question of experience as it is of grease on the surface of the cloth. If care is exercised in cutting off and tacking down the piece of tracing cloth, the chances are that no chalking will be required. But if the hands are slightly greasy, which is very often the case, the ink refuses to stick, and instead, follows the pen.

As to the "bite" wearing off in a period of 24 hours, it would be better to say that enough grease is rubbed on in that time to overcome the bite.

To take an extreme case, vaseline was rubbed on a piece of tracing cloth and, of course, the ink would not take. Then, on the same surface a little common flour was rubbed and found to give the required bite. So it is seen that anything that will absorb the grease without injury to the cloth is satisfactory. Common chalk, French chalk, flour, starch, fuller's earth, or gasolene may be used. Even the talc powders put up for toilet use will be found to serve the purpose.

J. K. MCINTYRE.

Newburgh, N. Y.

Ball Thrust Bearings with Cone Seats

It is rather difficult to understand from the letter which appears on page 606 relative to the above subject, whether the writer refers to both the lower race ring of the bearing and the seating ring or to the seating only. Judging from the statement which follows, however, namely, "with the cone seat it is further possible to center this ring of the bearing support," it is evident that his remarks apply to both rings.

A great deal has been published from time to time in this journal dealing with ball bearings; to those, therefore, who are interested in the subject a comparison between this letter and one published on page 651, Volume 33, Part 1, will prove instructive.

In the earlier letter your correspondent endeavors to prove that the spherical-seated thrust bearing is useless for the purpose of effecting alinement, while in the latter one it is stated that a bearing having a cone seat of 30 degrees or less is perfectly efficient for this purpose.

It is, of course, well known that some firms are making bearings upon the lines now advocated, but their reason for doing so is not equal efficiency but cheapness of manufacture.

But that the latter construction is entirely wrong must be evident to anyone who will give the matter a moment's consideration. It is obviously impossible for the coned ring of a bearing to take a seating upon a similarly coned seating ring except in one definite position. Moreover the acknowledged fact that the cone seating is helpful in centering the bearing is contradictory of the claim for efficiency as a method of alinement.

Some few years ago I had occasion to inquire carefully into the respective merits of the two types, and more recently, in order to confirm the conclusion then reached from the above and other considerations, I experimented with coned pieces having an included angle of 120 degrees. It was found that practically no relative movement of the two pieces was possible, but that the one always seated itself exactly in the same position upon the other; no attempt was made to take fine measurements but a pointer probably 18 inches long indicating against a zero mark was used and the results obtained were sufficiently definite to show the uselessness of the cone seat for the purpose in view.

That large quantities of cone-seated bearings have been constructed and are in use cannot be denied, but their success does not in any degree depend upon

the cone seat but rather upon the accuracy of the facings against which the bearings rest.

By far the simplest construction for this type of bearing is a combination of the two under discussion, the bearing ring being constructed on spherical lines, and the seating ring as a cone. It is necessary, of course, in adopting this construction to exercise care that the line of contact of the two rings comes directly under the balls, but if the radius of the face of the bearing ring is made equal to the diameter of the ball centers an angle of 30 degrees on the seating ring will insure this without further trouble.

HAROLD SIBBERING WOOD.

Coventry, England.

Scientific Management

It is not often that such an optimist as Mr. Du Brul unburdens himself in your columns, as at page 1181, Volume 34. He seems to be amused at everything on both sides of the scientific-management question. Yet he admits that his own personal experience is as limited as he assumes both Entropy's and mine to be.

But I do not quite understand his meaning in regard to adopting it as soon as conditions will justify. If scientific management is based on principles which are fundamentally sound (and I believe *real* scientific management is), it should help any shop under any condition at any time. Or can it be possible that he hesitates to risk the cost of installing "efficient management" until his bank account can stand a heavy strain?

I believe that a very small shop might find it difficult to maintain a planning department unless it washed the windows while the machinist was doing the work. But in a shop the size of Mr. Du Brul's, this should be easy, for Mr. Taylor recommends one planner to every 3½ workers, which would make quite a good-sized force in his shop.

I do not recall having said "it (the Taylor system) could not be done," although I did intimate that it might not be best in the long run, if carried to the extreme.

Did Mr. Du Brul ever buy a gold brick of any kind, and did he advertise the fact to his friends to prevent them from being similarly disentangled from their hard-earned coin?

It is barely possible that this natural hesitancy on the part of victims may be one reason why those who have tried it do not volunteer testimony on the other side. And if Mr. Du Brul is laboring under the delusion that all the shops which have been "scientifically managed," not by "near Taylor" methods, but by Mr. Taylor himself, form an unbroken galaxy of dividend payers, I should be pleased to give him the names of a few that hardly come in that class.

If scientific management has been going on for 30 years, as Mr. Du Brul states, why credit it to Mr. Taylor, as he does not claim so much himself? As a matter of fact, he claims very much less than some of his over-enthusiastic friends.

I happen to know Mr. Taylor, to know some of his assistants, and to know of his methods. I also know some of his successes and some of his failures, so that my criticism hardly comes in the "up a tree" class. I also know that he is blessed (?) with friends who are unwise enough to put him on a pedestal where very few men belong.

One of the great weaknesses of his system is the looking at the personality of the worker from much the same standpoint as the drill sergeant looks at the "rookie." And as some of us are coming to believe in peace rather than war, we do not feel that this attitude can secure the best results.

And if the great foundation principles of scientific management are so clearly defined, why do Messrs. Taylor and Emerson and Gantt all look askance at each other in spite of the fact that their names are coupled as deliverers of the race? Is it because each thinks himself the only Simon-pure authority? If this were true, the country would be badly off.

Once more let me express admiration for much that Mr. Taylor has done. His systematic time study is fine and should be used in all repeat work. But some of the hard and fast principles he advocates; his failure to recognize that men cannot successfully be treated as parts of the machinery; that there will be inefficient men until we know a great deal more about eugenics, and that they must be reckoned with, shows that in spite of his breadth of vision, he has missed some of the vital points.

Chicago, Ill. FRANK C. HUDSON.

How Would You Turn This Job?

On page 650 a question is asked as to how an elliptically shaped wagon-wheel spoke could be turned on the engine lathe; and on page 797 a line cut of a wabble center is presented to do the job. I do not quite see how a good symmetrical job can be turned out with this tool, as there is no positive throw to the wabble center, having to rely solely upon the pressure of the cut throwing it from side to side.

I have devised a simple scheme and present an illustration of my method for doing this job in the engine lathe.

A is a round cast-iron piece fitted over the nose of the live spindle and containing the circular cam groove, whose center is ⅛ inch further from the edge of the cutting tool than that of the live spindle. This piece is fastened to the headstock with screws, as shown. On the nose of the spindle is screwed the piece *B*, which is dovetailed a sliding fit for cam-roller arm *C*. For turning wood as is required in this case, the arm has two pegs for revolving the piece to be turned.

A nice way to trace this movement is to make a drawing, showing the circle *G* with the center lines, also drawing in the tool.

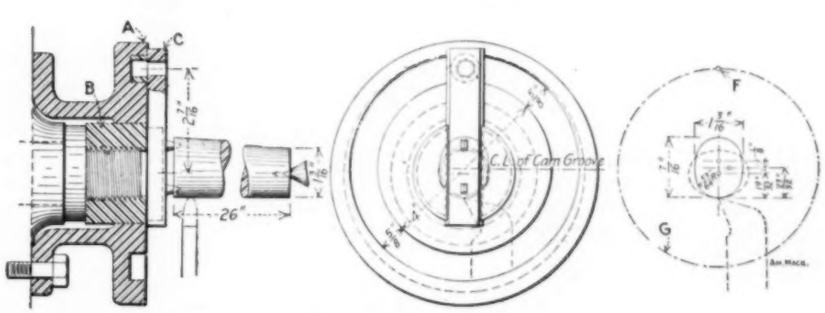
Upon a piece of tracing cloth draw the ellipse and cut a ¼-inch slot in it ⅛ inch each side of the center of the ellipse, shown in heavy line, stick a pin through the slot at *E*, driving it into the drawing board, stick another through at *F*, point up, enabling the head of the pin to slide around easily upon the drawing paper beneath, while we move it around on the circle *G* in the direction of the arrow; this will show you very nicely how the point of the tool is shaping the ellipse.

Much better results can be obtained with this latter experiment by enlarging it about six times.

Chicago, Ill. M. JACKER.

The Foundry Patternmaker

There are several statements in Mr. Parry's article, on pages 839 and 840, with which I do not agree. He says: "A first-class patternmaker is a man who has served time enough in a foundry as a molder to have learned that molders are also mechanics." Wouldn't it also be a good idea for molders to serve some time in a pattern shop so as to understand how to treat properly made patterns decently? How often do we see well made patterns having plenty of draft,



METHOD AND DEVICE FOR TURNING AN ELLIPSE

three or four coats of varnish, rapping plates, draw irons, etc., come back from the foundry practically ruined, often having only one or two dozen castings made from them, when, with any decent kind of treatment they ought to have been good for 500 or 1000 castings, if only varnished occasionally.

Undoubtedly, it would be beneficial for a patternmaker also to have some experience at actual molding; yet many of the most satisfactory patternmakers I have known—satisfactory from the foundryman's point of view, as well as from the pattern-shop standpoint—have never served any time in a foundry. It depends largely on the personal equation and the study the patternmaker has made of the subject, both from books and papers, like the AMERICAN MACHINIST, and by visiting foundries whenever possible and observing the operations of molding various kinds of work.

PROBLEMS OF THE PATTERNMAKER

There is such an immense variety of work especially to be found in some first-class job shops, that it makes it quite interesting for the intelligent workman. Many perplexing problems have to be decided, such as the most desirable methods for molding (sometimes, an article can be molded in several different ways, one of which would be easiest for the foundry, while another way might result in a *sounder casting*); then, having decided on the best way of molding, the question arises as to whether it is only a temporary pattern which must be made for the least possible outlay of time and material, or, if a permanent pattern, how to construct it so it will best resist the usually unnecessarily severe treatment patterns frequently receive in the foundry, resist the strains caused by the wood shrinking in the dry store room, and swelling in damp foundries, and also resist the natural tendency of much wood to twist (torsional strain) and glue to soften or get old and crumble. (I never like to trust glue alone, but add either nails, or preferably, wooden pins, also glued in).

PATTERN MAKING INCLUDES A GREAT VARIETY OF WORK

If a man is going to make large patterns his specialty, a practical knowledge of carpentry and joinery is of great benefit. Then we have store patterns, some of the work on which is only 1/10 inch thick and the making of which is practically a trade by itself; then we have patterns for brass goods, such as fittings for open plumbing, pressure regulators, small- and medium-size globe and angle valves, etc.; again, there is a great line of patterns for light machinery of all kinds, sweep work, gearing, both large and small, screw propellers, etc. We also have all kinds of metal patterns with several methods of gating or plating, requiring something a great deal better than a "handy man" to obtain satisfactory results.

WHY BLAME THE PATTERNMAKER?

Of course, we frequently confer with the foundries, so as to make patterns that can be molded easily with their equipment or to suit their pet ideas; yet how frequently do we find, after conferring with the foundry and making the patterns as directed, that they have altered the patterns and molded them some other way; and when we have sought for the reason, have perhaps been told that they changed their minds or that they gave the job to a different molder from the one they first intended, and he, evidently, had ideas of his own. So, why blame the patternmaker?

AN "IMPOSSIBILITY" MADE POSSIBLE

A lot of brass patterns were brought into our shop one day. There was a large slot cored in each pattern and this core also overlapped onto the main body of the casting, making a very ragged casting. Hence, we changed things so as to obviate that trouble, and the patterns were sent to the malleable foundry. In a few days, they came back again and the owner came with them, very red in the face and very angry. He proceeded to bless (!!!) us; he said the foundry could not cast from the patterns and they would have to be put back into their original form. I demurred, for I felt positive that they could be cast all right, and asked to be allowed to send them to another foundry for proof; but he refused. I then told him that I should put them back into their original condition if he insisted, but should charge for doing it. He declined to say anything, excepting that the patterns must be put back into their original form. Fearing trouble later on, I sent one of the patterns to a gray-iron foundry for proof and ordered three castings, not *snagged*, to be delivered as quickly as possible. Afterward, fearing some possible quibble, because of its being *gray* iron, I sent the pattern to two different malleable foundries with the same instructions.

Finally, the customer refused point blank to pay my bill, saying I had made a mistake and would have to stand the cost of rectifying it myself. I had to carry the case into court. The customer had the foreman of the malleable foundry, where he got his work done, for an expert witness. The foreman stated a lot of reasons why they could not be cast my way. We then passed him the three gray-iron castings with the foundry tag on them.

He was nonplussed at first, but finally discovered the tags and proceeded at great length to inform the court why it was possible to cast them of gray iron, and why it was an absolute impossibility to cast them of malleable iron. Then we handed him three of the castings bearing a malleable-iron foundry's tag; he colored up and began to stammer. Then we handed him the three from the other malleable foundry and he collapsed. I won the case.

Reading, Mass. W. A. SYLVESTER.

Another Internal Undercutting Tool

The number of articles published weekly in your columns in regard to internal undercutting tools show that the subject is of general interest. I know that they have been of great interest to me, as I have had to make this style of tool recently.

The first tool made is shown in Fig. 1, but was discarded on account of its limited movement, as when the tools were ground the cut would not be deep enough. The tool shown in Fig. 2 is one now in use and is proving very satisfactory. In Fig. 3 the work is shown with the undercut at *C*.

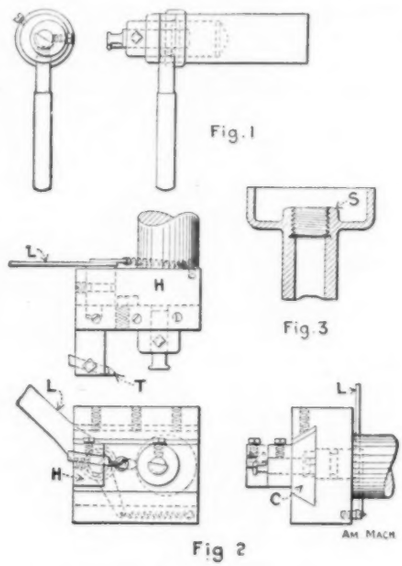


Fig 2

AN INTERNAL UNDERCUTTING TOOL

While this tool is not as ingenious as some of those shown in your columns, yet it has many advantages, not the least of which is its great rigidity and the unlimited movement. Another thing in its favor is the adaptability for other tools.

Chamfer *S*, Fig. 3, was formerly done with another operation, but is now done with the tool *T*, Fig. 2. This feature has been used on 18,000 pieces and is good for 10 times the number

JOHN F. SHEEHAN.

Washington, D. C.

No machine is best for every kind of work even though it may be able to do it. And there are many, perhaps inferior machines, which may be best for some particular kind of work.

Standards for Spline ane Square Shafts

The following report of the Broaches Division of the Standards Committee, Society of Automobile Engineers, showing practice of its members in the design of multiple spline shafts and square shafts, was made at their recent convention.

Multiple Spline Shafts (4 and 6 Splines). Fit to Come on Shaft at Bottom

The following formula applies when the fit is made to the reamed or ground part of the shaft between the splines, and the hole is ground concentric with the pitch line of the gear:

$$b = a + w + 2f \qquad (1)$$

where

b = Outside diameter of shaft;
a = Bottom diameter of shaft;
w = Thickness of key $= a \times 0.24$, ratio assumed;
f = Radius at corners of key and fillet $= \frac{a}{50}$.

An allowance of 0.006 is made for grinding in hole of gears.

The second formula is recommended for adoption as standard.

Square Shafts

It is recommended by the Division that we hold to one size to make the hole standard and the same size square for both sliding and fixed fits as far as the hole goes.

That in the determination of this standard we use the relation of the short diameter of the square to the long diameter of the square.

That in most cases, in our judgment, 0.8 will give satisfactory results for fixed and sliding fits. On sliding fits under very heavy duty this ratio will have to be carried to 0.73, using in both instances even fractional dimensions rather than decimal dimensions.

In regard to short diameter sizes to be established: these are to vary by ⅛ inch from ¼ to 1½ inches; by ¼ inch from 1½ inches to 3 inches; and ½ inch for 3 inches and above.

These limits take into consideration the manufacture of the parts and the change in sizes due to heat treatment and distortion of broach in hardening. Our experience shows us that these sizes will vary materially under different methods and we believe the limits given will produce a good commercial product under the varying conditions mentioned.

"a"	"b"	"w"	"f"	Shaft Size	
0.944	1.280	0.240	0.020	1	1.25
1.119	1.441	0.270	0.023	1.125	1.40625
1.244	1.600	0.300	0.025	1.250	1.5625
1.369	1.759	0.330	0.027	1.375	1.71875
1.494	1.920	0.360	0.030	1.500	1.875
1.744	2.240	0.420	0.035	1.750	2.1875
1.994	2.560	0.480	0.040	2.000	2.500
2.244	2.850	0.510	0.045	2.250	2.8125
2.494	3.200	0.600	0.050	2.500	3.125
2.744	3.520	0.660	0.055	2.750	3.4375
2.994	3.840	0.720	0.060	3.000	3.750

TABLE NO. 1, FROM FORMULA (1)

"a"	"b"	"w"	"f"	Hole Size	
1	1.250	0.300	0.020	1.000	1.250
1.125	1.40625	0.3375	0.0225	1.125	1.40625
1.250	1.5625	0.375	0.025	1.250	1.5625
1.375	1.1875	0.4125	0.0275	1.375	1.71875
1.500	1.875	0.450	0.030	1.500	1.875
1.750	2.1875	0.525	0.035	1.750	2.1875
2.000	2.500	0.600	0.040	2.000	2.500
2.250	2.8125	0.675	0.045	2.250	2.8125
2.500	3.125	0.750	0.050	2.500	3.125
2.750	3.4375	0.825	0.055	2.750	3.4375
3.000	3.750	0.900	0.060	3.000	3.750

TABLE NO. 2, FROM FORMULA (2)

Fit to Come on Outside Diameter of Splines

The second formula applies where the fit is made to the outside diameter of the splines. The hole is not to be ground but to be left as broached.

$$a = b - \left(w - \frac{5f}{2}\right), \qquad (2)$$

where,

$w = b \times 0.24$, ratio assumed;

$f = \frac{w}{15}$.

Both of the formulas are for four or six grooves. The adoption of an odd number is not recommended, on account of the difficulty of calipering the shaft at the bottom of the groove, the shaft at the top of the splines, or the hole diameter.

0.80 Ratio		0.73 Ratio	
Short Diameter	Long Diameter	Short Diameter	Long Diameter
⅛	⅛	⅛	⅛
¼	¼	¼	¼
⅜	⅜	⅜	⅜
½	½	½	½
⅝	⅝	⅝	⅝
¾	¾	¾	¾
⅞	⅞	⅞	⅞
1	1¼	1	1⅜
1⅛	1⅜	1⅛	1½
1¼	1½	1¼	1⅝
1⅜	1⅝	1⅜	1¾
1½	1¾	1½	2
1⅝	1⅞	1⅝	2⅛
1¾	2	1¾	2¼
1⅞	2⅛	1⅞	2⅜
2	2¼	2	2½
2¼	2½	2¼	2¾
2½	2¾	2½	3
2¾	3	2¾	3¼
3	3½	3	4
3½	4	3½	4½
4	5	4	5½

TABLE NO. 3. SHORT DIAMETER SIZES RECOMMENDED

An Inexpensive Flexible Curve or Rule

By M. R. Wells

Every draftsman has at some time or other probably felt the need of a flexible curve or rule, but the expense has led many to do without it.

One which I have found to be as good in practice as any I have ever tried can be made with almost no cost, as follows:

Procure two pieces of solder wire 3/16 inch in diameter and of the desired length. These can be straightened by rolling them on any smooth surface, and while in this shape, one side should be draw-filed to give a flat surface equal in width to perhaps half the diameter; at the same time the ends of the wire should be rounded.

Next, procure a piece of ¼-inch tubing (rubber) slightly longer than the pieces

Inexpensive Curve or Rule

of solder wire, and while the flat sides of the wires are held together, work the tubing over them in the same manner that tight glove fingers are first put on. This latter process will be much simplified if tubing is first soaked for a while in gasolene, which will cause it to increase in diameter for a short time, and will also act as a lubricant while placing the tube. The gasolene will soon evaporate and leave the tube tight on the wires.

A glance at the illustration will show the simplicity of the device.

A simple method of arriving at the relative merits of different grades of tool steel claimed to be satisfactory for ordinary commercial purposes, is pointed out by a contemporary as consisting of a steel disk about 24 inches in diameter and 2 or 3 inches thick, with a hole in the center about 3 inches in diameter. Then have one or two tools made from each sample of steel intended for purchase, and after cleaning the disk, set it in the lathe and try each tool on it, starting from the center, with a heavy cut and a fairly high speed. Then take the diameter of the disk at the point where the tool fails or becomes blunt and divide the price per pound of that particular steel by that diameter. Thus each tool will have a figure which will denote fairly accurately its commercial value. The depth of the cut must, in each test, be exactly the same and identical in every detail.

The Worm Gear as Applying to Motor Driven Vehicles*

By E. R. Whitney

The accompanying chart was made from the results of an efficiency test on a set of Hindley worm gears, used in the Commercial Truck Company's 1000-pound electric delivery wagon. The data on these gears are as follows:

Pitch	0.96 inches
Lead	3.84 inches
Ratio	9¾:1
Center distance	6.796 inches
Angle of thread (average)	28 degrees
No. threads in worm	4
No. teeth in gear	39
Diameter of worm	2.8 inches
Diameter of gear	11.917 inches

The test was made on a stock rear construction, the load being taken on a specially constructed Prony brake. The brake drum was mounted on a shaft with a square end passing through the square holes in both gears of the differential. The torque values were taken by a platform scale. The worm gear was driven by the electric motor, which is a standard series-wound automobile-type motor, and which has a normal rating of 85 volts, 22 amperes, 1200 revolutions per minute. Brake tests were first made on the motor, and before starting the test for efficiency, observations were made at various loads to determine the effect of varying the voltage and consequently the speed; it was found that the torque values on the Prony brake measuring the output of the gears was practically constant for a given current, with a considerably wide range of voltage and speed.

It is interesting at this point to note this fact in view of the results obtained by other experimenters, they having found a decided change in the efficiency with changes in speed. This may possibly be accounted for by the much higher surface speed of gears in this test, ranging from 200 to 800 feet per minute.

The fact that the voltage and speed could be disregarded greatly simplified the test, as it was then necessary to observe only current and torque, the efficiencies being calculated directly from the torque tests on motor and gears.

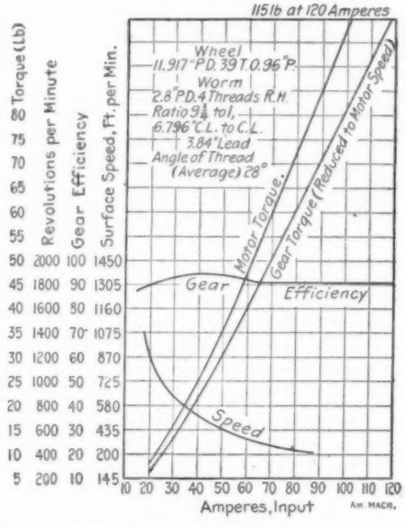
The curve of gear torque (see figure) is plotted from torque values on the worm gear divided by the gear ratio. The speed curve shows the motor speed at 85 volts with varying loads.

The test corresponds to actual service conditions with the wagon and full load, working through a range of from a slight down-grade to about an 18 per cent. upgrade. The maximum efficiency of 93 per cent. corresponds to a coefficient of friction of 0.032.

The durability or life of a worm gear is a direct function of efficiency and it follows that if a gear is produced that is high enough in efficiency throughout the full load range to be practical it will also be satisfactory for durability.

The Commercial Truck Company's first worm-driven wagons were put into service about two years ago. Some of the first wagons have now covered approximately 25,000 miles. Recent examination of the gears showed very little signs of wear. I would conservatively estimate the life of these gears at from 50,000 to 60,000 miles.

The worm-gear drive is not a cheap device, and the results as indicated above for efficiency and durability cannot be expected unless the gears are properly designed, constructed of the best materials and accurately mounted on high-grade anti-friction bearings. Unless facilities are at hand for doing accurate machine work, the use of the worm-gear drive had better not be attempted, but once properly constructed and mounted it is practically as free from trouble as a pair of spur gears. The gears illustrated in Fig. 4 are



Results of Efficiency Test on a Set of Hindley Worm Gears

mounted on fixed centers and with no provision for adjustment.

The Hindley worm gear is much more expensive than the straight type, but the superior bearing between the worm threads and gear teeth and the greater durability warrant the additional expense. The Commercial Hindley gear is a decidedly different product from the so called theoretically correct Hindley gear, and in practice the writer has experienced none of the fancied difficulties in mounting accurately enough in the direction of the worm shaft to meet all practical requirements; in fact, much less accuracy is required in this direction than is required at right angles to the shaft with the straight worm.

There is no such thing as a so called theoretically correct Hindley gear; that is, the threads of the worm do not have a full bearing against the whole area of all gear teeth in mesh, but the Commercial Hindley gear approaches very closely to this condition.

Some engineers claim that even in ratios that can be covered by a single reduction bevel gear the worm has advantages in a high-grade car in being much easier to make silent and has nearly equal efficiency. The efficiency is undoubtedly lower than with a single reduction bevel gear made with equal accuracy and equal mounting, but is considerably higher than a double reduction bevel and chain or chain and chain. We will assume that the legitimate field for the worm gear is only where its efficiency and durability are equal to or better than in the case of other devices to do the same work. Then, keeping in mind the principle underlying efficiency, the requirements for road clearance, etc., it would on this basis be limited to ratios of from about 6:1 to 14:1. These limits are an approximation only and are subject to modification, depending on exact conditions. In order to put in convenient form the comparison of all features of the worm gear with other forms of gearing, Table No. 1 has been made. In consulting this table it must be understood that the comments on the different ratios are not unalterable, although they are approximately correct for the usual form of construction.

Gear Ratio	Lower Than 6:1	6:1 to 14:1	Higher Than 1:4
Other forms of gearing.	Single reduction bevel.	Double reduction bevel and chain, chain and chain.	Double reduction (only required on heavy electric trucks) bevel and chain, bothchain both spur.
Efficiency	Lower	Higher	Lower
Durability	Equal or Better	Better	Equal or Better
Noise	Equal or Less	Less	Less

TABLE 1

	Speed M.P.H.	Engine or Motor Speed	Gear Ratio for 36" Wheels
GASOLENE VEHICLES Pleasure car...	40	1200	3.2
1000-pound wagon.....	20	1200	6.4
5-ton truck....	10	800	8.5
ELECTRIC VEHICLES Pleasure car...	20	2000	10.7
1000-pound wagon.....	15	1400	10.1
5-ton truck....	7	1600	24.4

TABLE 2

Table No. 2 has been drawn up to give some idea of the requirements for gear ratios with different types of motor-driven vehicles, and to indicate where the worm gear is applicable.

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American Machinist

In this issue, as a new feature, we print an "Outline of Topics" on page 133, and our former table of "contents" printed in this space has been dropped. This outline has been prepared especially for our busy readers who cannot perhaps afford time to read everything in each issue, but are nevertheless anxious that nothing of interest shall escape their notice. It gives the title of each article, the author's name, the page reference, and a brief sentence or two telling just what the article is about. We trust that it will be of service.

Our Foreign Commerce

The annual report on the foreign commerce and navigation of the United States for the fiscal year ended June 30, 1910, has just been distributed by the Department of Commerce and Labor. A glance through its nearly 1500 pages of statistics brings to light some facts which should be known to American manufacturers.

During the year there has been a decline in the exportation of food stuffs, an increase in the exportation of manufactures and an increase in the importation of manufacturers' materials. This is but a continuation of a tendency that has been observable during recent years. It points clearly to the fact that if we will continue to hold our position among the trading nations of the world, we must still further increase our exportation of manufactured articles.

To show this change in dollars and cents, in 1880 we exported $122,000,000 worth of manufactures, representing 14.78 per cent. of our total exports. The corresponding figures for 1910 are $767,000,000 and 44.85 per cent.

In 1880 we exported $495,000,000 forth of food stuffs, representing 55.77 per cent. of the total value of all exports. The corresponding figures for 1910 are $369,000,000 and 21.59 per cent. The decline during the decade 1900 to 1910 has been marked. The exports of food stuffs in the first year of this period reached the high mark of $545,000,000.

These facts show a progressive tendency toward rearrangement of the character of our foreign trade. Experts tell us that within a few years we will cease to export food stuffs and will probably begin to import food to feed our own population. If we are to maintain a position with the balance of trade in our favor, it is evident that we must push our manufactured articles into foreign markets to a greater degree than has ever been done in the past.

The most striking feature of the import trade during the last few years has been the increase in the importation of manufacturers' materials. In 1890 the total value of crude materials for use in manufacturing and manufactures for further use in manufacturing totaled $288,000,000, or 36.43 per cent. of the total importations. The corresponding figures for 1910 are $851,000,000 and 54.68 per cent.

The statistics quoted above show the enormous increase in the total of American exports during the past few years. When we turn to the detailed figures for the exports of metal-working machinery, we meet a striking contrast. Instead of a progressive increase we find a decrease, the total for the year 1910 being less than in any other year during the last five-year period, with the exception of 1909. Note the accompanying table.

Exported to	1906	1907	1908	1909	1910
Europe	5,825,505	8,423,471	6,859,319	2,853,605	4,832,916
North America	325,524	454,457	856,724	455,724	507,700
South America	50,742	136,070	238,866	113,373	305,069
Asia	114,507	255,551	514,430	88,374	147,957
Oceania	91,868	90,990	208,339	115,500	162,557
Africa	37,466	8,517	18,557	13,398	19,304
	6,445,612	9,369,056	8,696,235	3,640,034	5,975,503

EXPORTS OF METAL-WORKING MACHINERY (INCLUDING METAL-WORKING MACHINE TOOLS), YEARS ENDING JUNE 30, 1906-10.

The total amount for the year 1910 is a little less than $6,000,000. In that same period we exported $767,000,000 of manufactured products, excluding food stuffs. The metal-working machinery portion of this vast sum is pretty small. Turning once more to the table, we find that about 8/9 of the metal-working machinery exported to foreign nations went to Europe, and only 1/9 to all the rest of the world, including North America outside of the United States. Returning American ministers and consuls from South America and the Far East have pointed out the possibilities of the markets in those countries and urged our manufacturers to enter them. Apparently some other nation must be reaping the harvest, for excluding Europe and North America, in the year 1910 we only shipped a paltry $635,000 worth of metal-working machinery to the rest of the world.

Turn to the detailed figures for South America a moment, a place where we are supposed to be the guardians of liberty. Apparently our guardianship is being carried on for the benefit of European manufacturing nations, for in 1910 we shipped to South America the grand total of $305,069 worth of metal-working machinery. Of this $237,123 worth went to Argentina, leaving for all the rest of South America the sum of $68,000. A magnificent sum!

Are not these figures sufficient to show that American machinery builders are not reaching out for their share of the foreign trade of the world?

How Shall We Compensate for Industrial Accidents?

The justice of the principle of compensation for industrial accidents as opposed to employers' liability is so generally accepted in the United States today, that we are undoubtedly safe in saying that future legislation will be based upon this principle rather than on any other. Accepting this position we are at once met by the question: How shall the funds for this compensation be collected and administered?

There are two general methods to be considered. The first is compulsory compensation by law. This is the rule abroad. The other is voluntary compensation through associations of employers.

Able lawyers have given the opinion that the principle of compulsory compensation is unconstitutional. That is, an American legislature cannot lawfully require a master to pay a fixed compensation to a servant injured in his employ without regard to the cause of the injury.

If this is so, we still have another means at hand, systematic compensation by voluntary methods. Indeed it may well be that the voluntary method will be preferable for our American conditions. The agencies that administer the compensation funds in Germany are the employers' associations. With our faculty for business organization, can we not develop such associations or their equivalents to carry on this beneficent work here? Could any more beneficial social work be done?

Several plans along this line have already been considered and temporarily laid aside waiting for a clearer definition of what can and cannot be done lawfully. It is hoped that constructive action will not be deferred much longer.

Such voluntary administration of compensation could be sanctioned and aided by legislative enactment, by relieving employers who were members of such associations from being liable for damages for industrial accidents, except in cases where they were grossly at fault. A persuasive law of this nature would be a great aid to the voluntary method.

Turning to another phase, many lawyers have expressed the opinion that we cannot hope for federal action, but that whatever scheme of compensation is finally worked out must be done through the legislative powers of the individual States. This demands a general acceptance of the principle of compensation and a rational, lawful method of putting it into effect. In no other way can be hope for a reasonable uniformity between the laws of the various States, a uniformity which is highly desirable and which has been in no way attained by the legislation of the past few years on this particular subject.

Standard Sizes for Materials

The Society of Automobile Engineers is to be congratulated on its progress in standardizing materials to be used and on the stand being taken by its president, Henry Souther, as to the abolition of gages for sheet metal. The claim that calling for metal by thickness in thousandths would lead to more, rather than fewer, sizes, is hardly worth considering.

By determining on a set of standard thicknesses, varying by empirical amounts, the number of thicknesses to be carried in stock could be easily controlled. And the desire of some designers to use intermediate sizes would be easily curbed by making all sizes not on the list, special with a special price.

Those who fear confusion or the use of long terms instead of numbers need have no fear, as with 0.001 inch as the basis, we would say "875 sheet" for seven-eighths, and the great majority would be under "250" or quarter inch.

Any rational method which will get away from the uncertainty as to which gage is meant, will save more time, money and profanity, than we have any idea of.

New Publications

MECHANICAL DRAWING FOR HIGH SCHOOLS; in two books. By Percy H. Sloan, Berthe E. Spink, Carl Durand, Albert W. Evans, Fred W. Zimmerman. Book One, 65 cents; ninety 9½x6½-inch pages, with profuse illustrations and full-page plates. Book Two, 80 cents. One hundred and eighty-five 9½x6½-inch pages, thoroughly illustrated with diagrams and full-page plates.

These books, as their title shows, are for school use, the authors being connected with the Chicago high schools.

Book One begins with elementary geometrical constructions, proceeding to lettering, drawing of solid geometric figures and their developments, simple working drawings, shading, evolution and intersections of solids; isometric sketches, with the making of working drawings from these.

Book Two is the advanced course, being for fourth-year students. This includes linear perspective, shadows in perspective work, machine drawing, design of the various parts of a steam engine, this being shown in 16 plates.

Considerable space is devoted to architectural drawing, including the various details of a house, with numerous full-page plates.

THE PRODUCTION OF MALLEABLE CASTINGS. By Richard Moldenke. 125 6x9-inch pages, 35 illustrations in the text; indexed. The Penton Publishing Company, Cleveland, Ohio. Price, $3.

This book is an elaboration of a series of articles recently published in *The Foundry*, treating of all phases of malleable-iron production and written by the well known secretary of the American Foundrymen's Association. We believe it to be the first book ever published on this subject. Doctor Moldenke is recognized as an eminent authority on the subject of malleable cast iron, and in this book has given a comprehensive treatise covering the everyday problems confronting the producer of malleable castings, with a clear statement of the underlying principles of the process supported by a fund of information gathered through many years of practical experience. The malleable-iron business has always been looked upon as one jealously guarding its trade secrets. Many of these secrets are here uncovered, and in fact we are told that they were "often a mask for ignorance." The book contains 15 chapters with these headings: History, Early Development and Present Importance of the Malleable-Iron Industry; Characteristics of Malleable Cast Iron; The Testing of Malleable Cast Iron; The Pattern Shop; Molding Methods in the Malleable Foundry; Melting Processes; Construction and Operation of the Air Furnace; Construction and Operation of the Open-Hearth Furnace; The Use of Gas Producers in Malleable Foundries; Mixing the Charges for Malleable Iron; Casting Malleable Iron; Annealing Malleable Castings; Characteristics of Malleable Fractures; Use of Pyrometer in Annealing Room; Cost of Malleable Castings.

Personals

J. A. Bennett, chief engineer of the Studebaker Corporation's plant at South Bend, Ind., has resigned.

Edward Hawkridge, president of Hawkridge Brothers Company, Boston, sailed for Europe on July 4, for a two months' trip.

J. C. Manternach, sales manager of the tube department of the Standard Welding Company, Cleveland, Ohio, has been appointed general manager of that company's business.

W. O. Duntley, president of the Chicago Pneumatic Tool Company, is now in Europe, where he will spend several weeks in the interest of the company's foreign business.

R. A. Rung, who has been in the sales department of Schuchardt & Schütte, New York City, has taken a similar position with the Allied Machinery Company, with headquarters in Vienna, Austria.

W. H. Sawtell, for the past four years master mechanic of the L. S. Starrett Company, Athol, Mass., has resigned his position in order to become superintendent of the George D. Mayo Machine Company, Lanconia, N. H.

O. H. Linton has resigned his position with Niles-Bement-Pond Company, New York, and has become associated with Griggs & Holbrook, consulting engineers, New York, and will have charge of their Canadian business with headquarters at Toronto.

R. H. Wadsworth, for some time past assistant superintendent of the Waverly Company, Indianapolis, Ind., in charge of the design and manufacture of tools and jigs for work, has recently accepted a position as general superintendent and works manager of the Seneca Falls Manufacturing Company, Seneca Falls, N. Y.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

A New Hydraulic Clutch

The accompanying half-tones show a new hydraulic automobile clutch which is adaptable to line shaft, hoisting and conveying machinery of all kinds as well as numerous other applications.

This clutch is simple in its construction, consisting of an outer case keyed to a drive shaft eccentrically and being fitted with an oil-tight cover, and a drum keyed to the driven shaft concentrically so as to work snugly within this case, being mounted on two roller bearings, so forming a crescent-shaped cavity between the case and the drum. The case may be reversed, making the drum the driver and case the driven. Two or more wings, otherwise called blades, working through slots in the periphery of the drum swing about a pin centered on the case. Thus an eccentric motion is imparted to the blades which is taken care of by rocker bearings set in the drum. Cast in the case is a valve of the plunger type, operated in the usual way by a sliding sleeve, controlling a passage which has its entrance and exit at either end of the crescent-shaped cavity mentioned. There is a take-up plate screwed into the cover which is a sliding fit in the case and is operated externally by means of a rack cut on the plate and a pinion cut on a pin, having its bearing in the cover. All moving parts are accurately matched to a sliding fit, and as the entire mechanism is working in oil, friction is reduced to a minimum.

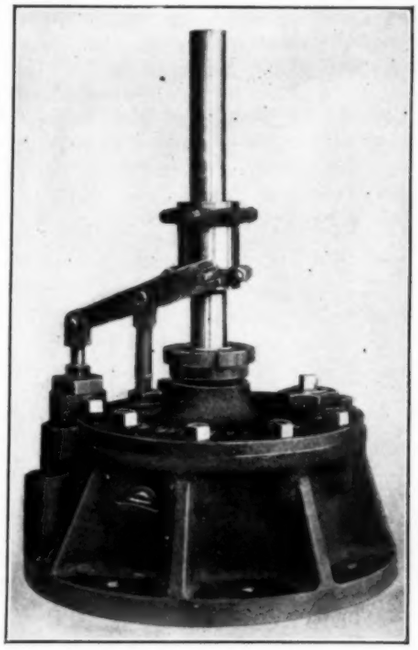


FIG. 1. NEW PATENT HYDRAULIC CLUTCH

The action when the valve is thrown open, allowing the oil to flow freely, is similar to a rotary pump, except that the oil never leaves the case, but flows continuously in a circular path. To set the clutch, simply close the valve, thus stopping the flow of oil and bringing the speed of the drum up to that of the case, or *vice versa*. This clutch does not compound power, but it is a variable speed clutch when so desired, and, as a positive coupling, has superior qualities.

Another feature is the smooth, easy manner in which it picks up the load, the valve being graduated to govern the flow of oil to a nicety. This is especially interesting to the automobile industry, as it eliminates the necessity of shifting gears when a reduction of speed without an increase of power is desired. The clutch is now being developed and manufactured by the Hydraulic Clutch Company, Citizens Bldg., Cleveland, O.

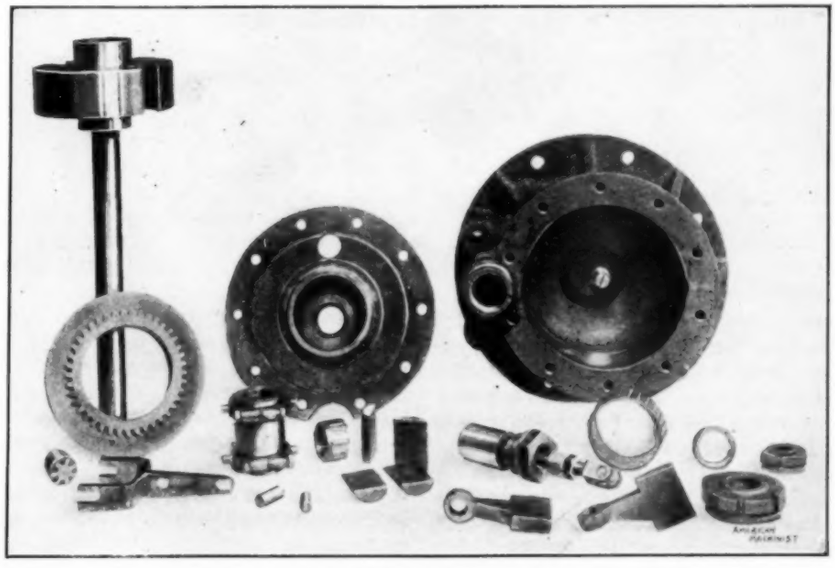


FIG. 2. HYDRAULIC CLUTCH PARTS

Spring Pipe Threader and Cutter

The accompanying halftone shows two tools recently developed by the Spring Pipe Threader and Manufacturing Company, St. Louis, Mo., for rapid cutting and threading of pipe. As will be seen a spring is utilized in each of the tools.

The threader shown in the foreground

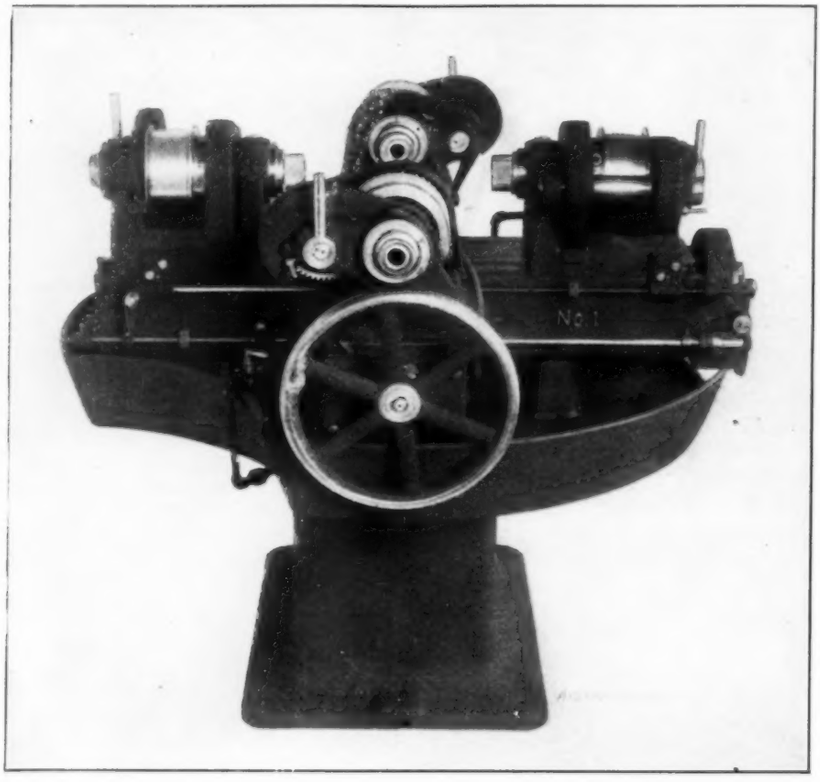
SPRING PIPE CUTTER AND THREADER

is operated by unscrewing the handle and allowing the dies to separate sufficiently to take the pipe to be threaded. The handle is then tightened and the threader rotated in the usual way, only two revolutions being necessary for a standard set of threads. By loosening the setscrew in the locknut at the handle the dies can be adjusted for deeper or shallower threads.

The operation of the cutter is immediately apparent. The handle is screwed up tight and the cutter turned, thus bringing into play the spring pressure.

Four Head Right Angle Driller and Turner

The halftone shows a similar machine to that described and illustrated on page 748, Vol. 33, Part 2. Improvements have been added and the present machine is back geared 3 to 1 so that it will drill four 1⅛-inch holes in drop forgings. The machine in its two designs was especially designed for machining automobile bevel-gear differential spiders and housings, and universal joint crosses and rings, and all that class of work where there are four holes or shanks to be drilled or turned at right-angles to one another and lying on the same plane.



FOUR-HEAD RIGHT-ANGLE DRILLER AND TURNER

The drive to the machine is taken from a four-way right-angle countershaft. The spindles have a threaded nose to allow for round box tools being used. A drill spindle inside of the main spindle is clamped by a single rack clamping device, and is provided with a Morse taper to receive drills or reamers. These spindles may be adjusted in or out very quickly.

The four heads are of heavy type construction, and are gibbed to the bed with taper gibs, which have slots in their end that interlock with a gib adjusting screw; thus a fine adjustment can be made. On the underside of each head and in their center is mounted a bracket carrying the feed nut, which is so constructed that the heads may be adjusted to or from the center independently; the nut being then clamped to the bracket through the socket screw shown on the side of the rear bearing. This feature allows for the fine adjustment necessary in facing shoulders.

The bed is of the cross-shaped, and in its center is mounted a jig-plate for clamping the fixtures that hold the work. On the side of the bed and in a position the operator stands are mounted the operating and tripping rods which connect with the rocker box carrying the worm meshing with a hardened-steel gear on the feed screw at the rear end of head; the feed drive being taken from the countershaft. The tripping device is constructed in such a manner as to accelerate the trip of the power feed on facing shoulders, reducing inaccuracy in lengths to a minimum. An adjustable collar is provided for the tripping device. The base is of the pan type construction, and proper lubrication of cutters and work is provided.

Deciding on the Best Machine to Use

BY JOHN R. GODFREY

We are all too apt to judge machines by the power they consume. In fact, we often hear machine builders tell with pride in their voices and victory in their eyes of machines which "take all a 10-horsepower motor can give them." And then, when we come to look at the work they have done, we sometimes wonder how on earth they manage to get rid of so much power in performing such a small amount of work.

I recall particularly an exhibition in which a number of machine tools took part and a heavy geared driller in particular. With a 1-inch drill this machine succeeded in stalling an 8-horsepower motor while drilling about 4 inches per minute in cast iron. A few days later I saw a sensitive driller drive the same sized drill through 4½ inches of cast iron in 1 minute with a 1-horsepower motor.

I am perfectly willing to allow for considerable difference in the size of horses in the two cases, and I presume that on an all-day run, the operator of the sensitive driller would perhaps work harder than the man on the all geared machine where the drill was fed by power.

There is considerable room for thought along this line and if we consider the first cost of the two machines and the fact that the extra power consumption means not only the cost of the power itself, but that it involves constant wear, as well as lubrication, it is quite possible that we could afford to pay the operator of the sensitive driller enough to make it well worth his while to expend the extra effort.

DEALERS' AND CUSTOMERS' DEMANDS

It is unfair to blame the makers of machines for all the monstrosities that have been prepetrated in the name of geared machines. We must remember that fashions change and that when customers get the idea that anything driven by a belt is necessarily out of date, their demands must be met in some way. Salesmen talk glibly about many things which they do not understand, and the manufacturer who is wholly dependent on agents is between the devil and the deep sea when it comes to designing and building machines, with his satanic majesty several laps ahead.

There appears to be only one way out of this dilemma, which is for the manufacturers to inaugurate and maintain campaigns of education so that custo-

mers may have a better idea of what they really need than they seem to have at present.

Of course, there are many cases where users of machines know their requirements better than any agent or manufacturer, and in some instances are compelled to build their own machines in order to secure just what they want. But in too many cases the man who signs the order is influenced almost entirely by salesmen or by catalogs which unduly emphasize certain features and entirely neglect the broad question of low cost production.

A Field for Efficency Engineers

One of the largest fields for those who are interested in real efficiency is the study of the best machines to be used on different classes of work with a view of keeping them as simple as possible in every way. Every unnecessary speed or feed, every additional gear or bearing means increased first cost, increased cost for attention, lubrication and repair, and an increase in the power required to drive the machine. And unless the output is increased in quality or quantity, or both, so as to more than offset all these, it may be cheaper to continue using the old machine, despite the fact that it cannot be the latest fashion.

A Method of Detecting Mineral Oil*

By Alexander E. Outerbridge, Jr.

A novel and valuable method of detecting mineral oil and resin oil in other oils. It consists in noting the degree of "bloom" or flourescence when the oil is viewed by transmitted light from an inclosed arc lamp. A very minute degree of adulteration can be detected. It is of value as furnishing an inexpensive, quick means of determining whether or not mineral oil has been added to vegetable oils intended for making oil sand cores in the foundry.

*Condensed from paper presented to American Society for Testing Materials.

The importance of having a rapid, simple and reliable method of detecting the presence of cheap mineral (hydrocarbon) oil, or resin oil, as an adulterant in expensive vegetable or animal oils, used in large quantities in industrial works, was forcibly impressed upon my mind some time ago by the following experience: The purchasing agent of the large manufacturing establishment with which I am connected handed me a sample of oil, of a rather dark color, which had been offered as commercially pure linseed oil, slightly off color, suitable for making "oil sand cores," at a concession from the market price of linseed oil.

Preliminary examination indicated that the sample was just what it was represented to be. A "skin test" was made by evaporating a drop or two to dryness in a shallow platinum capsule, and as it gave a good tough skin a trial lot of five barrels was ordered and used for making oil sand cores. This proved very satisfactory and in a short time another lot was bought. After thirty barrels had been purchased, complaints came from the foundry of cores broken in handling, and a larger proportion of oil to sand was used to overcome the trouble. Another shipment, making 45 barrels in all, was received and tested in various ways before being used in the foundry. I reported that this oil was, in my judgment, adulterated and unsuitable for making oil sand cores. The purchasing agent notified the shippers; they denied the charge and asked for payment. We then had samples tested by a well known firm of analytical chemists, who reported that the linseed oil was "largely adulterated with mineral oil and resin oil." On being asked to give the proportions they replied that it was a difficult thing to do and would cost much more than the amount of their bill. Still the shippers refused to remove the barrels, and wrote as follows: "We must insist upon immediate settlement and your check sent promptly will be appreciated." After some months' delay a copy of the State law making it a crime to sell adulterated linseed oil in Pennsylvania, unless so branded, under severe penalties, was mailed to the oil company. This brought a prompt request to send the oil back at shippers' cost, which was done; and the incident was then closed.

It started, however, a new line of investigation which has resulted in a method of instantly detecting such adulterations.

The "Bloom" of Mineral Oils

Mineral and resin oils differ from all other oils in many ways, but especially in one respect, and resemble each other in many ways, notably in one, which will now engage our attention.

When examined by reflected light, hydrocarbon oils (improperly named "mineral" oils), whether crude or partially refined, show a peculiar greenish tinge commonly called "bloom." When examined by transmitted light the bloom disappears and the true color of the oil is seen. This color ranges from dark red or mahogany tint through various shades of orange and yellow up to "water white," according to the degree of refinement. Resin oil possesses the same peculiar characteristics, except that the color of the bloom is pure blue. Its chemical composition is so nearly like that of a hydrocarbon oil that these resemblances appear to me to be more than accidental coincidences and suggest the possibility of a common origin between so called mineral oil and resin oil. This speculation, however, is not germane to our topic, which has to do strictly with a new practical application of that property commonly called bloom to the instantaneous detection of adulteration of vegetable or animal oils with hydro-carbon oils.

Doubtless everyone has noticed the bloom in mineral oils and wondered perhaps as to the cause of this singular greenish appearance, which is especially noticeable in crude oil and in heavy lubricating oils. Bloom is merely a popular name for a remarkable property possessed by a number of substances, the scientific name for which is "fluorescence."

In simple non-technical words, fluorescence is a property inherent in some substances of becoming self-luminous while exposed to certain rays of light known as "ultra-violet" or "actinic" rays. These rays are always found in sunlight and in some forms of electric light. If a beam of white light from the sun or from an arc-light be passed through a prism (preferably for some purposes made of quartz) it is separated into a broad band of prismatic colors. Such a beam may be likened for illustration to a closed fan; after passing through the prism the fan is opened, and it is seen that each fan-stick has a different color, namely, red, orange, yellow, blue, indigo and violet. Beyond the red, on one side of the prismatic band, and beyond the violet on the other, are many rays which are invisible to the eye; but some substances when placed in the path of these invisible rays become luminous or fluorescent, the color of the fluorescence being characteristic of the substance, some showing green, some blue, some yellow, some purple, some white and others various intermediate tints.

In the course of my investigations I found that the greenish bloom or fluorescence of mineral oil and the blue bloom of resin oil noticeable in daylight can be enormously intensified or magnified,

perhaps a thousand fold, under certain conditions to be described herein, so that, if a single drop of mineral oil be placed in a vessel containing a hundred or even a thousand drops of pure linseed oil, or any other non-fluorescent oil, its presence may be instantly detected by the greenish fluorescence which it imparts to the whole of the oil. The same is true of resin oil which gives blue fluorescence. The utilization of this observation for practical purposes of detecting adulterations is the gist of this paper.

A "Bloom" or Fluorescent Scale

By increasing the proportion of either adulterant the intensity of the fluorescence imparted to the naturally non-fluorescent oil is correspondingly increased; and, by preparing standard samples of any non-fluorescent oil containing one-tenth, one, two, three per cent., and upward, of mineral or resin oil, in clear glass test tubes placed in a suitable frame against a dark background, each showing readily and unmistakably the increasing proportions of the adulterant under a light giving ultra-violet rays, a "fluorescent scale" has been established, somewhat similar to the well known carbon scale used in steel foundry laboratories for quickly determining, by color comparison, the proportion of carbon in an acid solution of steel.

By comparing a sample of nonfluorescent oil which has been adulterated with mineral oil or resin oil with these standards, the proportion of such adulteration may often be accurately stated in a moment by anyone. I use the word "often" in connection with the quantitative determination advisedly, in order to allow for some modifications, to be explained further on; but I am prepared to unhesitatingly make the broad assertion without fear of contradiction that there is no method known by which the presence of either mineral or resin oil in any nonfluorescent oil in small or large amount can be so disguised as to be undetectable instantly by this method, and this certainly is an interesting and important fact of considerable practical value to consumers of costly oils.

De-bloomed Oil Can Be Detected

It is stated in text books on oil analyses, and also in elaborate works on oil refining, that methods of chemical treatment of mineral oil have been discovered to "de-bloom" mineral oil so that it can be used with impunity, so far as the bloom is concerned, as an adulterant for expensive vegetable and animal oils, and I learned that there is a very large trade in de-bloomed oils for this purpose. It was, of course, at once evident to me that my new process would be totally incapable of detecting adulteration of nonfluorescent oils with mineral oil when deprived of all bloom or fluorescence. Accordingly, I obtained samples of de-bloomed oils of different grades and colors. These samples are free from bloom in bright sunlight or ordinary diffused daylight, or in the light from an ordinary electric arc, but, when subjected to the kind of light which I shall presently describe they all became highly fluorescent. When I stated to a certain refining company that their samples of de-bloomed oil were far from bloomless, they expressed the greatest astonishment; they said there must have been some inexplicable error in selecting the samples and that they would forward new samples guaranteed to be "absolutely bloomless." The new bottles not only had the printed "de-bloomed" labels, but they had other labels with the word "bloomless" written on them. These samples were precisely the same as the others, all showing the same fluorescence under the ultra-violet light illumination.

I then prepared a new series of standards for comparison, made with this so-called bloomless oil, so that it is possible to readily state the fact and even the proportion of adulteration with de-bloomed mineral oil in any specimen of nonfluorescent oil mixed with such de-bloomed mineral oil. I anticipate that this positive statement now made for the first time, will cause some consternation among makers of de-bloomed mineral oil.

If both mineral oil and resin oil be used in combination as adulterants, it becomes more difficult to make quantitative determinations instantly by the fluorescent method; hence the qualification implied in the word often. But "practice makes perfect" in many operations and this is no exception to the rule.

It might naturally be supposed, in a method of comparison of this nature, that it would be necessary for all of the test tubes or phials used to contain the standards and the samples to be tested to be of absolutely uniform size, also that precisely the same quantities of oils should be used in all of the tests; such, however, is not the case. I soon noticed that the color of the fluorescence of any sample of mineral or resin oil was not changed by differences in the quantity of oil examined or in the dimensions of the bottles containing the specimens, differing in this respect, from the marked change in color of the same samples viewed by transmitted light in glass containers of different sizes. To illustrate this interesting observation I have prepared exceedingly thin films of mineral and resin oils (scarcely thicker than soap bubble films) by pressing a few drops of each between plates of clear glass and mounting them like lantern slides. Crude mineral oil and resin oil are very dark in color and are opaque in four-ounce bottles, but the films are so transparent as to be almost invisible when viewed by transmitted light of any kind. When placed against a blackground, however, and examined by reflected light from the source I employ, they fluoresce brilliantly in the same green and blue colors that large quantities of the same oils show under the same light.

The Light Used

It is the *ordinary inclosed arc*, so commonly used in industrial works by reason of its relative economy, that happens to give out rays of the exact wave lengths needed to enormously increase the fluorescence of these oils. If the plain glass cover of this light fits properly, so that air does not enter as rapidly as it is consumed, the arc burns in a partial vacuum or, at least, the air is rarified and, under these normal conditions, this light shows continuously, after burning a minute, a faint rosy light in addition to the powerful white light. If now a vessel containing any mineral oil, crude or refined, or any resin oil, be placed in the path of these rays the most intense fluorescence appears, even in daylight, greenish in the case of mineral oil, blue in the case of resin oil, the thin films already mentioned glowing in the same manner. So strong is this fluorescence that if one cubic centimeter of either mineral oil or resin oil be diffused in a bottle containing 99 cubic centimeters of linseed oil, or any non-fluorescent oil, its presence is plainly seen; and I have even detected one cubic centimeter of crude mineral oil in 999 cubic centimeters of non-fluorescent oil.

No Trace of Fluoresence in Vegetable Oils

I have examined a large number of vegetable oils, such as cotton-seed oil, corn oil, China bean oil, China wood oil, etc.; and have not found a trace of fluorescence in any of them. It is stated in some text-books that "oleic acid," which is found in lard oil, is fluorescent. On examination I find that pure white strained lard oil is entirely free from fluorescence under the ultra-violet ray, but all of the samples of so-called No. 1 or No. 2 lard oil (sold for use in machine shops) examined possess some fluorescence, and this may prove to be a novel means of rapid determining the proportion of oleic acid in lard oil, though I only suggest it tentatively, not having studied the matter carefully from this point of view. The slight fluorescence of ordinary lard oil is different in appearance from that of mineral oil or resin oil, and does not materially interfere with the application of the fluorescent test for its adulteration with mineral or resin oil.

There is a metal-cutting compound sold called "mineral-lard oil"—there is no deception here, for its name proclaims

its composition. The proportion of mineral oil in this compound is sufficient to cause intense fluorescence when examined under the rays of the inclosed arc.

In order to make a quantitative fluorescent oil analysis—if I may be permitted to coin such a term—in cases where the amount of mineral or resin oil in vegetable or animal oil is over 10 per cent., causing too great intensity of fluorescence for accurate quantitative determinations, it is simply necessary to dilute the sample to any desired degree for the test by adding sufficient pure vegetable or animal oil, as the case may be, to bring the proportion of adulterant within that of the prepared standards. Thus, if the sample of adulterated oil showing more intense fluorescence than the 10 per cent. standard is diluted with an equal quantity of pure non-fluorescent oil and then shows a degree of fluorescence corresponding with the 10 per cent. standard, it is safe to conclude that it contains 20 per cent. of fluorescent adulterant.

The Test in Daily Practice

In daily practice I have found it convenient to put the standards in narow tubular oil test bottles holding about fifty cubic centimeters each; these are corked, labeled, and placed side by side in small wooden racks (like test-tube holders) on a shelf in proximity to an inclosed arc-light, beginning with pure oil at the left-hand side, then a similar sample containing one-tenth per cent. of mineral or resin oil, as the case may be, then 1 per cent., and so on increasing by single percentages up to 10 per cent. It is advisable to prepare several different series of standards with fluorescent oils of different grades. Crude mineral or resin oils are much darker in color than refined oils and the color by transmitted light is a guide to the kind of oil that has been used for adulteration and is consequently an indication of the proper standard series to be used for comparison in making a quantitative fluorescent analysis.

It is not necessary to prepare standards for each kind of vegetable or animal oil; thus, the standard series prepared with linseed oil serves for examination of cotton-seed oil, corn oil, China wood oil, China bean oil, or any other non-fluorescent vegetable oil. It is necessary, however, to prepare special standards with lard oil for testing adulterated lard oils.

Oils for Oil Sand Cores

The making of oil sand cores has grown enormously in recent years and many thousands of dollars are spent annually by large concerns for oils for this purpose. The compounding of core oils has become a large business and nearly all samples that have come to my notice contain mineral or resin oil or both. Neither of these oils impart any valuable properties to core oils, but are used simply to dilute more costly oils; and, in point of fact, they are positively deleterious, being of a non-drying nature, impairing the good oil binder and requiring more fuel and a longer time for baking the cores in the ovens. When we realize that linseed oil (which is the best binder) costs, at the present time, in the neighborhood of one dollar per gallon and crude mineral oil about three cents per gallon, its use as an adulterant is readily explained. Resin oil costs a good deal more and is therefore used more sparingly.

I have found that "Soya" oil expressed from beans grown in enormous quantities in China and elsewhere, is an excellent substitute for linseed oil for making cores if used in its natural state, without having been compounded or adulterated by core-oil makers. It costs about sixty cents per gallon for fine grades. The very best substitute for linseed oil as a binder for oil cores that I have discovered is crude whale oil, costing about the same as Soya oil, the only objection to its use being an unpleasant fishy smell which escapes from the core ovens during the baking of cores. It makes a splendid binder. I am told it is now being de-odorized, but I doubt the effectiveness of any such treatment. Cotton-seed oil is used for the same purpose, but so much larger proportion of oil to sand is required that there is little economy in its use as compared with the other vegetable oils.

A Test of Value of Oils for Oil Sand Cores

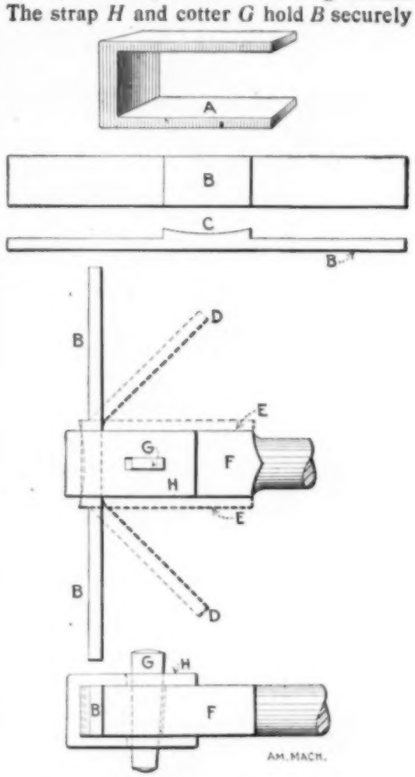
A simple and practical test of the value of core oils is to make a dozen companion test cores 1 by 1 by 15 inches from batches of pure linseed oil and sharp sand, and also from the same proportions of any other oil and sharp sand. These are placed side by side on an iron plate and baked under precisely the same heat conditions. When cold they are broken on a transverse testing machine with supports 12 inches apart. The relation between the average strength of the two sets of test cores is a measure of the binding qualities of the oils.

Forging Connecting Rod Straps

By E. A. Dixie

At *A* is shown a connecting-rod strap in which the corners are finished square. *B* shows the first operation. The part *C* is grooved in the center and left high at the ends so that when the sides of the strap are brought to position the ends will be approximately square.

The forging *B* is reheated and secured in the holder *F*, which has a long handle. The strap *H* and cotter *G* hold *B* securely



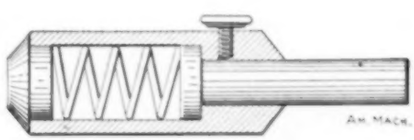
Forging Connecting-rod Straps

against the end of *F*. *B* is then bent to the position shown by dotted lines at *D*. This is done with the sledge hammer. It is then taken to the steam hammer and brought flat against *F*, as shown at *E*. The groove at *C* draws practically straight in this last operation and the straps come from the steam hammer with the corners square.

Accurate Caliper Setting Device

By D. Robertson

The device shown in the cut, I designed and use for setting calipers accurately. It is placed between the micrometer anvil and head; the micrometer then be-



Accurate Caliper Setting Device

ing adjusted to the size required and the small thumbscrew tightened. The spring inside is just strong enough to bring plunger back in place. Different rods in ⅛-inch advance can be made to suit requirements. I have found the device quick and accurate and it may be of use to others.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

E. A. Darling will build a new garage on Summer street, St. Johnsbury, Vt.

The Fort Hill Bronze Company, of Everett, Mass., will build an addition to its factory.

The American Steel and Wire Company, of Worcester, Mass., will build an addition to its plant.

D. G. Williams has received a permit to erect a tin shop and garage at 313 North Main street, Springfield, Mass.

The jewelry manufacturing shops of Scofield, Melcher & Schofield, Robinson Brothers and H. A. Gardiner & Co., Plainville, Mass., were burned. Loss, about $75,000.

The Liberty Manufacturing Company and its subsidiary, the Nichols Manufacturing Company, East Norwalk, Conn., manufacturing flexible tubing, sustained a fire damage of $20,000.

MIDDLE STATES

P. J. Brown, Cleveland, Ohio, will erect a large garage.

The Keller Company, Cleveland, Ohio, will soon erect a machine shop.

F. Mauran will have a garage erected on Ellena street, Philadelphia, Penn.

P. J. Browne, 1094 East Ninety-eighth street, Cleveland, Ohio, will erect a garage.

The Massillon Bridge and Structural Company, Massillon, Ohio, will erect a larger plant.

The Kissel Motor Car Company, Hartford, Wis., will erect a large addition to plant.

Improvements will be made to the plant of the Massillon Wire Basket Company, Massillon, Ohio.

Fire destroyed the plant of the Grant Brothers Foundry Company, Detroit, Mich. Loss, $12,000.

W. B. Holms is building a garage at Forty-Eighth and Park avenues, and will install new equipment.

The National Machinery Company, Tiffin, Ohio, is in the market for considerable additional equipment.

Thomas Madden, Son & Co., Indianapolis, Ind., will build a garage at Fletcher avenue and Harlan street.

The Heilman Automobile Company is building a large modern garage in Cumminsville, Cincinnati, Ohio.

The Atlas Steel Casting Company has filed plans for a $20,000 factory at 1963 Elmwood street, Buffalo, N. Y.

The American Fork and Hoe Company will erect a three-story machine shop for its Jackson, Mich., plant.

The Newark Plaster Company, Newark, N. J., will erect an addition to its plant to be used as a foundry.

A garage is to be built on the corner of Crossroads and Sycamore avenue, Merion, Penn., for Von H. Herr.

Building permit has been taken out by the Vulcan Steam Shovel Company, Evansville, Ind., for a $300,000 addition.

The Cincinnati Lathe and Machine Company, Oakley, Cincinnati, Ohio, has let contracts for an entire new plant.

The Easterbrook Pen Company will build a new factory at the corner of Delaware avenue and Cooper street, Camden, N. J.

The Cleveland (Ohio) Taxicab Company will erect a garage at East One Hundred and Seventh street, near Euclid avenue.

The Abbott Motor Company, of Detroit, Mich., has increased its capital $1,000,000 and is planning to increase output.

The Perfection Spring Company, now at 2414 Superior avenue, Cleveland, Ohio, is planning the erection of a new plant.

The Winkley Company, of Detroit, Mich., is to erect an addition to its factory. The concern manufactures oil and grease cups.

Fire destroyed machine shop, foundry, boiler and engine rooms of the Ohio Iron and Brass Bed Company, Eaton, Ohio. Loss, $15,000.

Additions and repairs to the extent of $60,000 will be made to the plant of the American Sheet and Tin Plate Company, Elwood, Ind.

The Pioneer Brass Works, Indianapolis, Ind. (molders and finishers), will build an addition to its plant at 424 South Pennsylvania street.

The American Steel and Wire Company (Cleveland, Ohio) has options on 150 acres of land at Solon, Ohio. A big new plant may be erected there soon.

The Berlin Machine Works, of Beloit, Wis., building woodworking machinery, has decided to establish a branch plant in Portland, Ore., to cost about $750,000.

The Duplex Printing Press Company, Battle Creek, Mich., is contemplating improvements, including new foundry, machine shop and erecting department.

The Adams-Bagnall Electric Company, Cleveland, Ohio, manufacturing motors, dynamos, etc., will soon erect a six-story factory, costing about $62,000.

Daniel O'Connell, F. J. Geiger and L. W. Mulford are having a two-story garage erected at Nineteenth and Morris streets, Philadelphia, Penn., to cost $10,000.

The Metropolitan Gas and Electric Fixture Company, Cleveland, O., has been incorporated to manufacture gas and electric fixtures of all kinds, by F. A. Landry and others.

The Northern Ohio Traction and Light Company has purchased near Akron, Ohio, a tract of land upon which will be erected large shops to take care of repair work.

All Makes Typewriter Exchange Company, Chicago, Ill., has been incorporated to manufacture, repair and deal in typewriters, etc., by Wm. A. Capesius, Le Roy Hackett, etc.

The Novelty Tool Company, North Vernon, Ind., has been incorporated with a capital of $10,000 by H. H. Dowd, F. K. Gettwallis, Harry Dicks and others to manufacture tools.

The Strong Steel Foundry Company has bought a site and will build a foundry in the Elmwood-Hertel district of Buffalo, N. Y. It is now located at Main street and city line.

The Sharp Aëroplane Company, Cleveland, O., has been organized with $10,000 capital to manufacture aërial craft. Incorporators, James G. Reyaut, K. C. Morris, John Sharp, etc.

Chicago (Ill.) Motor Transportation Company has been organized with $100,000 capital to do general automobile and auto livery business. Will build and install a repair shop.

The Johnson-Van Vlaanderen Machine Company, Paterson, N. J., manufacturing dyeing, printing and finishing machiery, has secured site on which a new five-story plant will be erected.

The Carnegie Steel Company will soon begin work on a new $25,000 addition to the Bassett-Presley factory on East Thirty-Ninth street, Cleveland, Ohio, which was recently purchased.

The Russell Wheel and Foundry Company, Detroit, Mich., manufacturing cars and structural steel works, is to increase its capital stock for the purpose of extending its facilities.

The Imperial Fluid Gauge Company, Cleveland, Ohio, also Akron, Ohio, has been incorporated for $50,000. J. W. McFerran, president. Will manufacture gasolene gages, etc., for automobiles.

Lowa's Garage, Yonkers, N. Y., has been incorporated with $30,000 capital to conduct garage, etc. Incorporators, Wm. Lowa, 44 Carolina avenue; Wm. Lowa, Jr., 219 Riverdale avenue, etc.

Ninth Street Garage, New York, has been incorporated to maintain garage, etc. Capital, $20,000. Incorporators, Max Steinhardt, 52 Willett street; Marcus Goldschmidt, 73 Nassau street, etc.

The Bedford Harrow-Drag Company, Bedford, Ind., has been incorporated with a capital of $10,000 by A. J. McDonald, E. E. Mitchell and T. C. Underwood, to do a manufacturing business.

The Windermere Garage Company has been incorporated with $10,000 capital to operate a garage in East Cleveland, Ohio, and to deal in automobile supplies. W. H. Atkinson, M. J. Miller, K. F. Leet, etc.

The Lima Welding Company, Lima, Ohio, has been incorporated with $1000 capital to work a new oxyacetylene process of welding metals. Incorporators, M. P. Colt, John Mahan, S. S. Wheeler, etc.

The North Indiana Bridge Company, Michigan City, Ind., has been incorporated with

$40,000 capital to manufacture bridge and structural work. Directors, J. L. Jackson, E. D. Church, S. S. Roby, etc.

Approximately $2,000,000 will be spent by the Illinois Central Railroad Company this summer for improvements along its lines, including substantial additions to buildings and track, in and adjacent to Chicago.

Richard H. Thomas, Inc., New York, has been incorporated to manufacture and deal in gas engines, mill supplies, etc. Capital, $12,000. Incorporators, J. M. Shellabarger, E. M. Hardy, 30 Church street, etc.

The General Engineering Company, Cleveland, Ohio, has been incorporated with $10,000 capital to engage in the manufacture of electrical equipment. Incorporators, E. E. Beam, C. W. Hartley, V. E. Davis, etc.

The Scioto Valley Traction Company, of Columbus, Ohio, is having plans prepared for a large yard and shops at Reeses, a station southeast of Columbus. It is announced that $40,000 will be expended for the shops.

The Neidig Typewriter Company, Chicago, Ill., has been incorporated to manufacture, repair and deal in typewriters, etc. Capital, $250,000. Incorporators, Francis W. McGovern, W. L. Simonton, Alfred Barstow.

The Interstate Pattern Company, Cleveland, Ohio, has been incorporated with $10,000 capital to engage in the manufacture of patterns, dies, etc. Incorporators, H. F. Pratt, A. R. Roethlisberger, H. G. Arthur, etc.

The plants of the Federal Storage Battery Company, West Orange, N. J., and the Landsen Company, of Newark, N. J., the latter building electric automobiles, will be moved to Silver Lake. The Edison Company is interested largely in these concerns.

The Radio Manufacturing Company, of Columbus, Ohio, has been incorporated with a capital of $50,000 by E. W. Brinker, J. C. Spangler, John H. Carpenter, Howard Lewis and Chester C. Moelchert to manufacture automobile radiators and accessories for motor cars. The plant will be located on East Spring street.

SOUTHERN STATES

The Halo Gas Company, Nashville, Tenn., has been organized to manufacture the Halo gas engines. Incorporators, H. J. Witt, J. M. Williams, L. J. Rust, etc.

The Southern Virginia Motor Car Company, Pocahontas, Va., has been incorporated by W. L. Mustard, W. H. Walters, J. Walter Graybeal, etc. Will construct garage.

WEST OF THE MISSISSIPPI

Wm. Schultheiss, San Diego, Cal., has taken out a permit to build a new foundry.

The Southern Pacific Railroad is preparing to erect new repair shops and roundhouse at Gerber, Cal.

The New Orleans, Mobile & Chicago Railroad is negotiating for a site for shops at Laurel, Miss.

C. W. Boost, Portland, Ore., will build a commercial garage and repair plant. Modern machinery will be installed.

R. C. Halliday, Spokane, Wash., will build a large commercial garage and repair plant. About $10,000 will be expended.

The blacksmith shop, hoist house, etc., of the Trojan Mining Company, at Greenmont, S. D., was destroyed by fire.

The Denver & Rio Grande Railroad will spend $60,000 on enlargements and improvements at its shops in Salt Lake City.

H. P. Hendrickson, Artesia, Cal., is planning for the erection of a commercial garage and repair plant. Modern machinery will be installed.

Henry E. Bothin, Santa Barbara, Cal., is having plans prepared for a large commercial garage and repair plant. Modern machinery will be installed.

The California Motor Car Company, Los Angeles, Cal., is having plans prepared for a four-story commercial garage and repair plant. Modern machinery will be installed.

The Santa Fé Railroad is preparing plans at its Los Angeles, Cal., offices for new machine shops and roundhouse to be erected at Barstow, Cal., replacing those destroyed by fire.

The Los Angeles (Cal.) Rotary Engine Company has leased property at Long Beach, Cal., and will establish an engine-manufacturing plant. New machinery will be installed.

The Northern Pacific Railroad is having plans prepared for new car shops and roundhouse to be erected at Pasco, Wash. A new power plant will also be installed. Estimated cost, $600,000.

The Sacramento (Cal.) Wire Mattress Company, recently incorporated, is planning for the erection of a plant for the manufacture of its product. Murray Laidlaw is head of this company.

C. A. Brode, Los Angeles, Cal., has had plans prepared for a commercial garage and repair shop on South Olive street. Modern machinery will be installed. F. L. Stiff, architect, Los Angeles.

The Kaymer Automatic Press Company has been incorporated at Phœnix, Ariz., with a capital stock of $1,000,000, to establish a plant for the manufacture of printing presses. Celora M. Stoddard and M. LaRue are incorporators.

The Portland (Ore.) Railway, Light and Power Company will build a large plant, comprising repair shops and car factory on Holgate and Milwaukee streets. The buildings will consist of general repair and construction shop, foundry, blacksmith shop, woodworking shop and paint shop. Estimated cost, $400,000.

CANADA

The Vulcan Foundry Company will build a big addition to its plant.

Polson Iron Works is to build a dry dock at a cost of $894,000, at Toronto, Ont.

The Gordon Nail Company, of St. John, N. B., will locate a large new plant at Calgary.

The Gutta Percha Rubber Company, of Toronto, is building new machine and repair shops.

A big new plant will be equipped at Brantford, Ont., for the Brantford Motor Truck Company.

Canadian Locomotive Works, at Kingston, Ont., is about to make extensive additions to its plant.

The International Harvester Company will equip a big new branch factory at Fort William, Ont.

W. D. Beath & Son will equip a new manufacturing plant in Toronto. The concern manufactures carrier systems.

National Screen and Wire Company, of Albion, Mich., will erect a branch plant at Windsor, Ont. Cost, $20,000.

GENERAL MANUFACTURING

NEW ENGLAND

Fitchburg, Mass., will extend sewer system.

Spencer, Mass., will extend its sewer system.

Cambridge, Vt., will install a new water system.

Central Falls, R. I., will extend its sewer system.

South Deerfield, Mass., will extend its water system.

The Fiske Paper Company will rebuild its mill at Hinsdale, N. H.

The chair factory of E. S. Taylor, Sterling, Mass., was destroyed by fire.

The Old Colony Gas Company will build a new gas plant at Weymouth, Mass.

The International Paper Company, of Hartford, Vt., will build a new mill.

Putnam, Conn., will issue $100,000 bonds for the installation of a new water system.

O. P. Berry Company, of Wolfboro Falls, N. H., will build an addition to its power plant.

The Boston Confectionery Company will build a new three-story factory at Cambridge, Mass.

The Saco Valley Corn Canning Company, Portland, Me., will erect a plant in Belfast, Me.

Cheney Brothers, South Manchester, Conn., silk manufacturers, are completing new $500,000 mill.

J. D. Clarke & Co. (satinet manufacturers), Rockdale, Mass., will build a new dye house.

The American Paper Goods Company, Kensington, Conn., will make extensive additions to its plant.

The Berkshire Woolen and Worsted Company, Pittsfield, Mass., will erect an addition to its plant.

Aetna Hosiery Company, 40 Vine street, Worcester, Mass., was damaged by fire to the extent of $500.

The Clifton Manufacturing Company, Jamaica Plain, Mass., is in the market for direct-current electric motors.

Central Falls, R. I., has voted to install two new boilers in the town buildings. The common council has this in charge.

The Memorial Hospital, Belmont street, Worcester, is contemplating installing electric motors for kitchen and laundry service.

The Peoples Wet Wash Laundry, Manchester, N. H., is going to buy a boiler and engines, 125 and 75 horsepower, respectively.

The Brattleboro (Vt.) Dairy Company will install a cold-storage plant and equipment for sterilizing cans, bottles and apparatus in its dairy.

The Columbian Packing Company, Lubec, Me., is rebuilding plant which recently burned. This includes sardine factory, lumber mill and smoke houses.

The Gilbert & Barker Manufacturing Company, Springfield, Mass., making fuel-oil burners, gas machines, etc., has secured site in West Springfield for new plant.

The plant of the Nicholl Turbine Company and the Liberty Manufacturing Company, making rubber and metal specialties, East Norwalk, Conn., were damaged by fire to the extent of $20,000.

The Mason Weaving Company, Westboro, Mass., will move into the Hassall plant recently vacated by the Hunt Metal Corner Company. It will greatly enlarge its capacity and will require new machinery.

MIDDLE STATES

Oak Harbor, Ohio, will install a municipal waterworks plant.

The plant of the W. G. Ward Lumber Company, Ironton, Ohio, was burned.

The plant of the Ironton Tool Handle Company, Ironton, Ohio, was burned.

The Pewabic Pottery Company, of Detroit, Mich., will erect an addition to its plant.

The Nazareth (Penn.) Cement Company is enlarging and overhauling its power plant.

The National Distilling Company, Milwaukee, Wis., will erect a $25,000 still house.

The Hanna Paint Company, Columbus, Ohio, will erect a paint-manufacturing plant.

Forest City Electric Company, Cleveland, Ohio, will make changes to its present plant.

The Saginaw, Mich., water board will install two engines at the west side waterworks.

Fire destroyed the excelsior mill of E. F. Sheffield, at Mooers, N. Y., entailing a loss of $7000.

The Sufferle Cooperage Company, Cincinnati, Ohio, will erect a two-story factory building.

Fire damaged to the extent of $75,000 the plant of the Volney Paper Company, at Fulton, N. Y.

The Wilmer Atkinson Publishing Company is having a five-story plant erected at Philadelphia, Penn.

The Standard Powder Works, Hollidaysburg, Penn., was partially destroyed by explosion and fire.

The Western Union Telegraph Company has appropriated $40,000 for improvements at Dayton, Ohio.

The plant of the Belle Vernon-Mapes Dairy Company, at Cleveland, Ohio, was partially destroyed by fire.

Oberlin (Ohio) Gas and Electric Light Company has increased its capital and will make improvements.

The village council at Newberry, Mich., will spend $4000 for installing additional machinery at the light plant.

William J. White has leased a building in Niagara Falls, N. Y., to manufacture White's Yucatan chewing gum.

The Indiana & Michigan Electric Company, South Bend, Ind., will construct a power house at Elkhart, Ind.

The Oshkosh (Wis.) Soap Company is planning the erection of a two-story plant. Ralph M. Thissen, secretary.

The village of Baraga, Mich., is considering the installation of an electric-light and water plant to cost $35,000.

The Central Veneer Company, Indianapolis, Ind., will build an addition to its plant at Winter street and Belt Railroad.

The Post Publishing Company, Jamestown, N. Y., has completed plans for the erection of a new modern printing plant.

The plant of Hanselman Candy Manfacturing Company, of Kalamazoo, Mich., was destroyed by fire. Loss, $175,000.

The Lastlong Underwear Company, Oswego, N. Y., is to build an addition to be used as a dye house and bleachery.

The village of Camden, N. Y., voted at a special election to spend $1800 for installing a second unit in the municipal lighting plant.

The Detroit, Toledo & Ironton Railway is improving its road bed and equipment and shortly will be in the market for motive power.

The Marietta (Ohio) Torpedo Company's boiler house and several other buildings were destroyed by an explosion, causing a loss of $30,000.

The Baltimore & Ohio Southwestern Railway Company has made an appropriation for an addition to its boiler room at the Cincinnati shop.

Andover, Ohio, will receive bids for waterworks machinery. Specifications may be obtained from J. W. Cook, clerk of the board of public affairs.

The Cleveland Knitting Mills Company, Cleveland, Ohio, has incorporated for $100,000, and will soon consider a new plant to increase capacity.

S. Marksen & Co. have let the contract for a $15,000 building at 2807-11 Lake street, for dyeing and cleaning works and will install new machinery.

The Harshaw, Fuller & Goodwin Company will add another building to its chemical works at Elyria, Ohio. An electric power plant will be installed.

The plant of the Gardner White Brick Company, at Sandford Corners, N. Y., was destroyed by fire. Plant was owned by W. H. Gardner, of Philadelphia.

The Bainbridge Canning Company, Bainbridge, Ind., has been incorporated with a capital of $6000 by William Darnall, Milton Brown, D. A. Davis, etc.

City of Cleveland, Ohio, has under consideration the overhauling of the pumps at Old Division Street pumping station and using same for fire service.

James A. Sweeney, of Plymouth, Ind., is at the head of a movement to establish a cement-post factory at Tell City, Ind. The enterprise will be financed by Tell City capitalists.

The Patent Vulcanite Roofing Company, of Chicago, Ill., has purchased the plant of the American Strawboard Company, at Anderson, Ind., and will convert it into a felt mill.

The Beach City Electric Light and Power Company, Beach City, Ohio, $35,000, to erect a plant for the manufacture of electric power, A. H. Elliott, Iva Arnold, W. H. Smith, etc.

Hagen & Reufer, proprietors of the recently burned plant of the New York Piano Key Company, at Middletown, N. Y., are preparing to erect a larger factory to replace it.

The Capital Cooperage Company, Fort Wayne, Ind., manufacturer, has been incorporated with $10,000 capital. Directors, O. R. Brokaw, J. B. Brokaw and C. P. Millikin.

W. S. Sargent, city clerk at New Lisbon, Wis., will receive bids up to 1:30 p.m., July 19, for the erection of an electric-light and water plant. Aug. H. Meyer, engineer, Appleton, Wis.

The Davenport Wagon Company, Moline, Ill., has been incorporated with $300,000 capital to manufacture wagons, etc. Incorporators, Wm. Butterworth, W. L. Velie, G. W. Mixter, etc.

The C. A. Nelson Drain Tile Company, Beaver Dam, Ohio, has been incorporated to manufacture drain tile and brick. Capital, $10,000. Incorporators, C. A. Nelson, Clinton Coning, etc.

The North Indiana Brick Company, Michigan City, Ind., has been incorporated with a capital of $40,000 by J. L. Jackson, E. D. Church, J. C. Reinke and others to manufacture bricks.

The K. W. Window Company, Cleveland, Ohio, has been organized with a capital of $75,000 to manufacture window sashes, frames, etc., by E. E. Kilmer, M. D. Kilmer, G. P. Nash, etc.

The Holden Clay Products Company, Mineral City, Ohio, has been organized to manufacture all kinds of clay products by Maynard H. Murch, C. C. Owens, G. M. Breen, etc. Capital, $10,000.

The Home Telephone Company, La Paz, Ind., has been formed to maintain and operate a telephone system. Capital, $10,000. Incorporators, J. W. Burger, J. W. Hildebrand, Wm. Hildebrand.

The Frolicker-Helmers Shoe Company, of Maysville, Ky., has purchased the spoke factory building of Col. Victor Oberting, at Lawrenceburg, Ind., for $10,000, and will remodel it for a shoe factory.

The G. R. Tuescher Company, South Bend, Ind., which was recently incorporated, will immediately establish a new baking plant, site having been secured. Directors, P. C. Fergus, C. T. and G. R. Tuescher.

The Henson Manufacturing Company, Springfield, Ohio, has been incorporated with $10,000 capital to manufacture a newly patented railway lantern. Incorporators, O. R. Henson, T. E. Underwood, C. C. Florida, etc.

The Toledo Cooperage Company, Toledo, Ohio, has been incorporated with $12,000 capital to engage in the manufacture of cooperage supplies. Incorporators, A. E. Scheble, J. G. Hickox, T. J. Livingstone, etc.

The Elmwood Auto Top and Supply Company, Elmwood Place, Ohio, has been organized with $50,000 capital for the purpose of manufacturing tops for vehicles. Incorporators, F. A. Lee, J. P. Anderson, R. A. Nessel, etc.

The Gary, Hobart & Eastern Traction Company, Gary, Ind., has been incorporated with a capital of $125,000 by W. H. Clinton, A. Z. Olson, A. J. Smith and J. C. Cavender to construct and operate an electric railroad from Gary, Ind., through Hobart to Valparaiso.

E. D. Johnston, Connersville, Ind., is preparing to equip electrical power plants; one to occupy the old waterworks site and the other to be built at the south end of the city, near a mill. A small reserve plant of 400 horsepower will be situated between the two larger plants.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 1 for hacksaw blades, grommets, hardware, planes, hand tools (schedule 3745), rod brass, phosphor bronze, pig iron (schedule 3746). August 8—Saddles for multiple drilling machine (schedule 3749).

Chicago, Waukegan & Fox Lake Traction Company has been incorporated to construct a railroad from Waukegan to Woodstock. Principal office, Chicago. Capital stock, $2,500,000. Incorporators, Chas. A. Spenny, Columbus, Ohio, W. P. MacGackon, Irving D. Stevens, Peter B. Olson, H. S. Hodberg, of Chicago.

The Auglaize Power Company, Toledo, Ohio, has been incorporated with $1,000,000 capital to furnish hydro-electric power to serve eight counties in the northwestern section of Ohio. One plant will be erected on the Maumee river, near Toledo, and another on the Auglaize river, at Defiance. Jas. M. Ashley, president.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids July 18, for six motor generators (schedule 3738), 55 lockers (schedule 3740), cast steel wire, bolts and nuts, files, machine, wood screws (schedule 3735), track bolts, frogs,

switches, rails, ties (schedule 3731). July 25—Core-making machine, sand-mixing machines, pneumatic sand shakers (schedule 3748).

SOUTHERN STATES

The Terra Alta Woolen Mills, Terra Alta, W. Va., was burned. Loss, $100,000.

L. B. Grandy, Mayesville, S. C., contemplates establishing a small ice plant.

Fire destroyed the Suffolk Knitting Mills, at Suffolk, Va., entailing a loss of $57,000.

Fire did about $12,000 damage at the plant of the Southern Seating and Cabinet Company, Jackson, Tenn.

Lawrenceville, Va., will vote on issuing $50,000 bonds for construction of waterworks, sewer system and electric-light plant.

The Farmers Ice and Canning Company, Tampa, Fla., will construct a new ice, cold-storage and canning plant to replace the one destroyed by fire.

Fire destroyed the plant of the Loomis & Hart Manufacturing Company, furniture manufacturers, Chattanooga, Tenn. Loss estimated at $100,000.

The Hancock County Electric Company, New Cumberland, W. Va., has been incorporated with $12,000 capital to construct and operate a power plant. Incorporators, John F. Flood, H. E. Armstrong, N. D. Miller, etc.

WEST OF THE MISSISSIPPI

The Port Moody (Cal.) shingle mill was destroyed by fire.

The Lehigh Cement Company, Mason City, Iowa, is erecting a $2,000,000 plant.

The city of Cascade, Mont., is planning for the installation of a waterworks system.

The city of Myrtle Point, Ore., plans for the installation of a new sewer system.

The Consolidated Marble and Stone Company, Joplin, Mo., will erect a new mill.

The Bitter Root creamery, at Stevensville, Mont., was burned. Will be rebuilt at once.

The plant of the Weir Wardrobe Company, at Mason City, Iowa, was destroyed by fire.

The David Cole Creamery Company, at Omaha, Neb., will erect a $40,000 creamery.

The council at Ellensburg, Wash., is planning the installation of a waterworks system.

The Columbia Creosoting Company, Portland, Ore., will build an addition to its plant.

The Ajax Waste Mills, Dallas, Tex., is said to be preparing to rebuild its plant recently burned.

The Barr Clay Products Company, at Zumbrota, Minn., will shortly commence erection of a plant.

Geo. W. Florida, of Delano, Minn., will repair the Rockford dam and install an electric-light plant.

The Alpine Wood Company, Berkeley, Cal., has taken out a permit to build an addition to its plant.

The Olympia (Wash.) Truck and Manufacturing Company will install new machinery at its plant.

The plant of the Seattle (Wash.) Cracker and Candy Company was damaged by fire. Loss, $100,000.

The sawmill plant, including machinery, of Chester Merriam, Dobbins, Cal., was destroyed by fire.

The Malad (Ida.) Electric Company is planning to install an electric-lighting plant at Caldwell, Ida.

The Pacific Lumber Company, Riverside, Cal., has taken out a permit to build an addition to its plant.

The plant of the Seattle (Wash.) Cracker and Candy Company was partially destroyed by fire. Loss, $50,000.

The Blackduck (Minn.) Cooperage Company will erect a heading and stave factory. M. D. Stoner interested.

The Whittier (Cal.) Citrus Association will build a new fruit-packing plant. Modern machinery will be installed.

The city of Sumas, Wash., will vote bonds for the erection of a municipal electric-light, power and heating plant.

H. C. Myer, Pasadena, Cal., is planning for the installation of a number of pumping plants near Phœnix, Ariz.

The Northern California Power Company, Sacramento, Cal., is planning to build a new substation at Kennett, Cal.

G. W. Stever, Buckley, Wash., operating a brick and cement-block manufacturing plant, will install new machinery.

The Twin Peaks Mining Company, Twin Peaks Camp, N. M., contemplates the erection of an ice-manufacturing plant.

The Coburn Planing Mill Company, Springville, Cal., will build a new plant to replace that recently destroyed by fire.

W. S. Anderson and H. H. Wallace, Escondido, Cal., are planning for the erection of a number of new pumping plants.

Crawford & Davis, Holtville, Cal., are contemplating the erection of a creamery plant. Modern machinery will be installed.

The city of Helena, Mont., will hold an election to vote bonds for $400,000 for the acquirement of a waterworks system.

The Los Angeles (Cal.) Paper Box factory has been incorporated by M. J. Ruthbard and I. Cline. A plant will be established.

The Deeth (Nev.) Mercantile Company is planning to install a new electric-lighting plant. A franchise has been granted.

The Oregon Power Company, Eugene, Ore., has been granted a light and power franchise at Halsey, Ore., and will install a system.

L. S. Bonney will build a sawmill plant on the Linnhaven Orchard tract, near Lacomb, Ore. Modern machinery will be installed.

The Coast Clay Company, Bellingham, Wash., will equip its plant with new machinery for the manufacture of high-grade brick.

R. E. Easton is planning to establish a gas plant for light, heat and power at San Luis Obispo, Cal. A franchise has been asked.

The Los Nietos Fruit Growers' Association, Rivera, Cal., will build a new fruit-packing plant. Modern machinery will be installed.

The Northern Brewery Company has leased property at Second and Washington streets, Portland, Ore., and will establish a brewing plant.

H. W. Boetzkes, Chelan, Wash., is planning for the installation of a telephone plant and system in this section. A franchise has been granted.

The San Dimas (Cal.) Lemon Association is having plans prepared for an addition to its packing plant. Modern equipment will be installed.

The Electric Water Company, Bakersfield, Cal., is planning to install a waterworks system at East Bakersfield. Estimated cost, $160,000.

M. G. Hope, Vale, Ore., is at the head of a company which plans to erect a large cement-manufacturing plant. About $200,000 will be expended.

The Washington Consolidated Telephone and Telegraph Company, Davenport, Wash., is planning to install a plant and system in this section.

The Treadwell Gold Mining Company, near Douglas, Alaska, will build a large power plant at Nugget creek. About $500,000 will be expended.

The city of Porterville, Cal., plans to make improvements in its waterworks system to cost $50,000. The city engineer is in charge of the work.

A central power plant to serve a number of buildings will be installed in the building to be erected by the Pomona (Cal.) Investment Company.

The Hon-Pattberg Realty Company, Deming, N. M., will build a number of electric pumping plants, and a central power plant, near Iola, N. M.

The Consolidated Gas and Electric Company, San Diego, Cal., has taken out a permit to build a new boiler house. The building will cost $25,000.

Miller & Lux, Inc., San Francisco, Cal., have taken out a permit to build an addition to their wool-pulling plant. Modern equipment will be installed.

The Jack Creek power plant, near Tuscarora, Nev., was destroyed by fire, caused by lightning stroke. Loss estimated at $55,000. The plant will be rebuilt.

The California Eucalyptus Lumber Company, Los Angeles, Cal., is having plans prepared for a new sawmill and planing mill to be erected at Oxnard, Cal.

Power-plant equipment will be required in the new office building to be erected by the Trustee Company, Seattle, Wash. About $350,000 will be expended.

The Standard Oil Company is planning for the erection of a large distributing plant at Richmond Beach, near Seattle, Wash. About $1,000,000 will be expended.

The Iowa Auto Tire Filler Company, of Des Moines, Iowa, will erect a factory at 307-11 East First street. T. W. McNar, president; W. C. Nelson, general manager.

The Michigan Buggy Company, Kalamazoo, Mich., is said to be planning for the erection of a branch factory for the manufacture of automobiles at Spokane, Wash.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., will double the capacity of its plant at Redding, Cal. Considerable new equipment required.

The Portland (Ore.) Railway, Light and Power Company is having plans prepared for a new power house to be erected on Lincoln street. Estimated cost, $100,000.

The Bayview Townsite and Water Company, Bayview, near Spokane, Wash., will build a waterworks system near Cœur d'Alene, Ida. A franchise has been granted.

The Peacock Milling Company, Milton, Ore. (grain), will build a new plant to replace that recently destroyed by fire. The plant will be erected on an increased scale.

The Spokane Falls Gas Light Company, Spokane, Wash., plans for the erection of a new plant to cost about $500,000. Henry L. Doherty & Co. control this company.

The Golden West Brewing Company, Oakland, Cal., is having plans prepared for a new plant. Modern machinery will be installed; the plant will be fully equipped.

Glodding, McBean & Co., Sheridan, Cal., will build a large addition to its pottery-manufacturing plant in Lincoln. Estimated cost, $40,000. Modern machinery will be installed.

The Imperial Valley Cement Works, Holtville, Cal., is planning for the erection of a new plant. Modern machinery will be installed. F. K. Hedrick is head of this company.

Power-plant equipment will be required in the new building to be erected by Edward Rolkin, San Francisco, Cal. Estimated cost, $80,000. M. J. Lyons, architect, San Francisco.

The California-Fresno Oil Company, Fresno, Cal., will rebuild its refinery plant recently destroyed by fire. New machinery will be installed. A. Ruschaupt, president, will receive bids.

The Klamath Falls (Ore.) Water Users' Association is planning to purchase the government power site at Keno, and build a large power plant. Bonds for about $500,000 will be voted.

The Southern California Preserving Company, Ontario, Cal., has been organized, and is planning for the erection of a modern fruit-canning plant. C. E. Christensen is head of this company.

Joseph Mitchell, Venice, near Los Angeles, Cal., is having plans prepared for an ice-manufacturing plant with initial capacity of 25 tons daily. A plant for the manufacture of ice cream will also be established.

Henry McLean, Seattle, Wash., is at the head of a company which is planning for the erection of a large plant at Mount Vernon, Wash., for the manufacture of linoleum. The new factory will be fully equipped.

The Mt. Hood Railway, Light and Power Company, Portland, Ore., will build a new power plant at Sulphur Springs, on the Cowlitz river. The initial capacity will be 25,000 horsepower, and will later be doubled.

The Pacific Gas and Electric Company, San Francisco, Cal., will make improvements in its plants and system near Chico, Cal., to cost $125,000. The capacity of the plants will be increased and new generating equipment installed.

At a meeting of the directors of the Imperial Valley Oil and Cotton Company, Calexico, Cal., it has been voted to rebuild the ginning plant (cotton) recently destroyed by fire. New machinery and engine equipment will be installed.

The board of supervisors, Los Angeles, Cal., will receive bids until August for two engine-generator sets for the Hall of Records. Copies of plans and specifications at the office of Hudson & Munsell, architects, Los Angeles. H. J. Lelande, county clerk.

CANADA

Blyth, Ont., will extend its electric-lighting plant.

Sarnia, Ont., will equip a new electric-lighting plant.

New Westminster, B. C., will install a new sewage system.

Port Stanley, Ont., will equip a new hydro-electric station.

Milltown, N. B., will equip a new power and heating plant.

Westmount, Que., will spend $500,000 on a new sewage system.

Nanaimo, B. C., will equip a new power station and a new sewage system.

St. Catherines, Ont., will make important extensions to its waterworks plant.

La Chute, Que., will make important extensions to its waterworks pumping plant.

Toronto is calling for tenders for 3500 feet of riveted steel pipe of 6 feet diameter.

Vancouver, B. C., will spend $1,310,000 on new waterworks machinery and extensions.

J. Coates, of Edmonton, is interested in a new $230,000 gas plant that will be equipped there.

Brandon, Man., will buy $25,000 worth of new steel rails and equipment for its street railway.

American Smelter Company will commence the erection of a $36,000 plant next month at Kingston, Ont.

The Standard Chemical Iron and Lumber Company, of Winnipeg, will build a big addition to its plant.

The Shawinigan Water and Power Company is building a big new power house at Shawinigan Falls, Que.

The Canadian Canners Association will equip a very large new plant at Port Hope, Ont., with the latest machinery.

The E. W. Gillett Company, of Toronto, Ont., will erect a large factory for the manufacture of yeast, baking powder, etc.

The Wagner Electric Company, of St. Louis, Mo., has increased its capital stock and will locate a branch plant in Montreal, Canada.

The Rolla L. Crain Company will equip a new printing and lithographing plant at Ottawa, to be equipped with the latest machinery.

Brandon, Man., will electrify completely its present steam-driven waterworks pumping plant and will add two 2,000,000 variable-speed pumps to its equipment.

MINING

The Gold Bug mine, near Kingman, Ariz., is planning to install a stamp mill.

The Table Mountain mines, near Mina, Nev., plan to install a stamp mill in the near future.

The Las Animas mine, near San Javier, Sonora, Mex., will install new concentrating equipment.

The Old Glory mine, Oro Blanco district, Ariz., will install new operating and surface machinery.

The Inspiration Copper Company, near Miami, Ariz., is having plans prepared for a concentrating plant.

The Dorrit mine, near Idaho Springs, Colo., is said to be contemplating the installation of a new milling plant.

The stamp mill of the Maddox mine, Tuolumne district, Cal., was destroyed by fire. A new mill will be erected.

The Antelope Valley Gold Mining Company, near Antelope, Cal., will install a new stamp mill in the near future.

The Golconda mine, near Kingman, Ariz., will increase the capacity of its concentrating mill from 50 to 75 tons daily.

The Sleeping Beauty mine, near Moore's Flat, Cal., will make improvements in its stamp mill and install new equipment.

The Mazeppa mine, Tuolumne district, Cal., will install new operating machinery, including a large compressor, in the near future.

The Frisco Mines and Power Company, near Kingman, Ariz., operating the Gold Crown mines, will increase the capacity of its stamp mill.

The Pennsylvania mine, near Browns Valley, Yuba county, Cal., will double the capacity of its stamp mill and install new electric machinery. J. C. Campbell is head of this property.

The Pacific Copper Mining and Milling Company, operating in Stevens county, Wash., is contemplating the installation of a stamp mill. M. E. Hosea, Spokane, Wash., is head of this property.

BUSINESS ITEMS

The firm of Clum & Atkinson, of Rochester, N. Y., has been dissolved, Philip A. Clum withdrawing from the partnership and George Atkinson succeeding to the business.

The Willsea Works has purchased the foundry and machine business recently conducted by the estate of J. Emory Jones, Rochester, N. Y. L. P. Willsea is president and treasurer of the new company.

FORTHCOMING MEETINGS

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Working drawings made from sketches or specifications; detailing and designing done; sheet metal layouts made; rates reasonable. Box 26, AMERICAN MACHINIST.

Competent mechanical engineer, N. Y. City, designs special and automatic machines and tools for all kinds of duplicate work; highest references. Box 852, AMER. MACHINIST.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Chief draftsman for mechanical department of large corporation building a general line of cranes, coal and ore handling machinery, etc.; must be a man of large experience and have good knowledge of structural work; position permanent at good salary; location, northeast. Box 61, AMERICAN MACHINIST.

Wanted—Mechanical partner with eight to ten thousand dollars capital in growing business in Canada; no encumbrance; must possess thorough knowledge of jig designing; to produce small interchangeable parts requiring rapid and accurate assembling; also gear cutting and building of marine motors. Address P. O. Box No. 682, Montreal, Canada.

DELAWARE

Wanted—First class operator for Jones & Lamsen turret lathe. Modern Machinery Co., Wilmington, Del.

IOWA

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, AM. MA.

MARYLAND

Wanted—Capable mechanical draftsman with five years' actual experience, especially marine engines; give character of experience and salary desired. Ellicott Machine Company, Baltimore, Md.

MASSACHUSETTS

Wanted—First class car draftsmen, those familiar with wood and steel car experience preferred; none but first class men need apply. Osgood Bradley Car Company, Worcester, Mass.

Wanted—General superintendent for a large and successful manufacturing concern employing high grade skilled labor; applicant must be man of first class mechanical ability and familiar with modern production methods, having a large and successful experience in handling help; he must also be capable of organizing various mechanical departments and be proficient in obtaining the fullest efficiency of same. Box 17, AMER. MACH.

MISSOURI

Wanted—"Cracker Jack" mechanical draftsman, one with technical education preferred, who can advance to position of chief draftsman; must be rapid and accurate and of good personal appearance; give age, experience, education and salary expected. Box 57, AM. M.

NEW JERSEY

Wanted—First class meter designer for large manufacturing establishment; permanent position for competent man. Box 49, AMERICAN MACHINIST.

We will have openings for machinists and toolmakers during July; mail your application, giving references and wage at last place. Crane Motor Car Company, 96 West Seventh street, Bayonne, N. J.

NEW YORK

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 984, AMERICAN MACHINIST.

Wanted—Two first class operators of horizontal boring machines; state age, experience and references; applications considered confidential. Box 23, AMERICAN MACHINIST.

Machinists Wanted—First-class machinists who can furnish references, apply in person or by letter. F. A. Fay, Supt., William E. Quimby, Inc., 548 West Twenty-third street, New York City.

Wanted—An experienced draftsman accustomed to machine construction; a good future for suitable man; give age, experience and copies of references. Snow Wire Works Co., Rochester, N. Y.

Wanted—Superintendent for automobile factory; one who has had experience in high class work only will be considered; must be a good handler of men, and a good systematizer. Apply, stating experience, Box 65, AMERICAN MACHINIST.

Wanted—Machinists wanted, lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—First class tool and die makers, drop-forge die sinkers, Fox lathe hands; steady position, good wages, no labor trouble; apply by letter, giving detailed account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Salesman for line of pliers and some high grade specialties to visit jobbing and retail trade east and west; must also visit machine shops to introduce specialties; state age, experience, territory covered, salary desired and references. "K. F.," AMERICAN MACHINIST.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

OHIO

Two gas engine erectors and assemblers wanted. Box 68, AMERICAN MACHINIST.

One drafting room man wanted, familiar with gas engine construction. Box 67, AM. M.

Wanted—For Chicago territory an experienced crane salesman; man with mechanical engineering experience preferred. Box 30, AMERICAN MACHINIST.

Position open for an experienced superintendent who can find a first class manufacturing business to be removed to a central Ohio city; we have the factory property and the capital. Box 63, AMERICAN MACHINIST.

General superintendent for machine shop employing 400 men; must be conversant with modern shop practice, system and cost accounting, strictly high grade; state age, experience and full details first letter. Box 52, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Practical machinist, experienced in rate setting and time study work; must be familiar with steam engine or pump work. Box 48, AMERICAN MACHINIST.

Machinists Wanted—First class lathe, planer, boring mill and bench hands. Address Mr. Wm. J. Casey, Shop Superintendent, The Jeanesville Iron Works Co., Hazleton, Pa.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—50 tool makers; experienced men on jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter, stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

VERMONT

Salesmen—We want several salesmen to sell Gridley automatics; applicants should give full particulars as to experience and state salary expected. Box 66, AM. MACH.

WISCONSIN

Wanted—Assistant foreman; a practical tool and die maker; we want an intelligent man possessing executive ability and able to lay out tools for cutting and drawing light sheet metals; a man with experience at making cooking utensil tools preferred; state age, salary wanted and where you have been employed. Address Supt., 880 Downer Ave., Milwaukee, Wis.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

I have had well balanced technical and practical experience of 15 years specializing on tools and machinery for the manufacture of machinery and metal products, including automobiles and machine tools, as machinist, chief, draftsman, designer and manager; wish responsible position in this line; 32 years old and can furnish references to interested parties. Box 74, AMERICAN MACHINIST.

My fifteen years' experience in shop, foundry and drafting room and office in the manufacture of high grade machinery, with record as a designer, originating and developing new ideas and keeping product uptodate, is available to any manufacturer who is in need of a high grade man, experienced as chief draftsman, mechanical engineer and manager; at present employed. Box 73, AMER. MACH.

MAINE

Manager or superintendent of machine shop, forge or foundry; first class references. Box 996, AMERICAN MACHINIST.

NEW JERSEY

Mechanical engineer, with office and shop experience, desires position in Metropolitan district. Address "E.," Box 51, AMER. MACH.

NEW YORK

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Toolmaker; fine tools, experimental or model work; qualifications A-1; references A-1. Box 71, AMERICAN MACHINIST.

Designer of crude-oil high-compression reversible engines, open for responsible position of design or construction. Box 999, AM. MA.

Practical stock keeper, fifteen years' factory experience, six years stock keeping, familiar with perpetual inventory methods, etc., now employed, wishes change. Box 72, AM. MA.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Superintendent, practical tool and instrument maker, inventor and designer, large experience in manufacturing, expert in automobile accessories, is open for position; A-1 references. Box 75, AMERICAN MACHINIST.

Mechanic, 34, American, expert tool, die and experimental work; now foreman in assembling department on fine and very close work; inventive ability with considerable technical knowledge; experienced on gas engines, 2 and 4 cycle; open to engagement about August 1. Box 69, AMER. MACHINIST.

NORTH CAROLINA

Mechanical engineer, 32, as superintendent or engineering capacity; technical education; four years shop, 10 years drawing room; is open for position. Box 70, AMER. MACH.

OHIO

Designer, experienced in dies, punches and automatic machinery, wants position. Box 64, AMERICAN MACHINIST.

Draftsman, specialist in automobile work, wide experience, excellently recommended, a good man, open for a good position. Box 62, AMERICAN MACHINIST.

Experienced (20 years) superintendent or master mechanic desires change; modern shop methods; executive and an organizer; good references. Box 58, AMERICAN MACHINIST.

PENNSYLVANIA

First class draftsman with eight years' experience, wants position. Box 8, AM. MACH.

Designer on special machinery, ready to develop ideas, desires change. Box 9, AM. M.

Competent draftsman, with three years' varied experience, would like a situation near New York; best of reference. Box 40, AM. M.

FOR SALE

For Sale—A complete machine shop with large lot, equipped with first class machinery, located along the East Penn Railroad. For further particulars and prices apply to P. B. Nuss, Alburtis, Penn.

Talks With Our Readers

By The Sales Manager

A manufacturer with a new product came into the office a few days ago and wanted information regarding advertising.

We gave it to him and showed him how our paper reaches and is read by the men in responsible charge of machine-making plants, how an advertisement in the AMERICAN MACHINIST will be a good investment for him, provided his product has merit.

We explained to him our policy of inserting advertisements from reliable concerns only, and stated that inasmuch as he was not known to us, we would be obliged to have references in regard to his reliability and also know whether his product had merit. We told him that this was no reflection on him or his product, but we had to do this in order to protect our readers.

He gladly gave us the references required, and we are investigating these now. If his product has the merit that he claims, his announcement will appear in our columns—otherwise it will not. And he has plenty of money to pay the advertising bills, too.

This manufacturer stated, "I have run up against something different here. Heretofore my life has been made almost a burden by advertising men soliciting my business. They do not seem to care whether my product appeals to their particular class of people or not. I am simply another victim—they want my business, that's all.

"As for investigating the truth of my claims, you are the first one to bring up the subject.

"You strike a new note—you say you will let me advertise provided I furnish references as to the worth of my product. Moreover, you do not talk space, but service. You offer to render a service—get up a definite, specific plan of presenting my product to my possible customers in the machine-making field and give them information.

"Yours is the paper in which I shall advertise, because any paper that takes the trouble to protect its readers as you do, must have their full confidence and this is the kind of paper that I want to have my advertising in."

Of course we are anxious to get new advertising, but we are not so anxious to get it as to overlook the fact that only reliable and truthful advertising pays in the long run.

Any other kind of advertising in our paper will not only hurt the advertiser, but will hurt us in greater proportion.

To be in our columns is a badge of responsibility, to buy from here is a guarantee of satisfaction.

* * *

Only reliable products can be continuously advertised.

Combination Turret Lathe Work

Western Correspondence

Methods of machining castings of various kinds requiring external, internal and facing cuts; with simple tools held on a cross-feeding turret.

Work held for the first operation in a three-jaw chuck is transferred to a faceplate for the second operation and located by a central plug or disk.

Some details of machine design and construction.

The 2¼x26-inch combination turret lathe, built by the Acme Machine Tool Company, Cincinnati, Ohio, was illustrated in these columns at page 228, Volume 34. In the present article are shown some methods of machining castings of various forms on this lathe, together with certain interesting details of design and construction.

It will be recalled that the system of stops on the carriage of the machine and the series of stops for the cross-feeding movements of the turret, permit the tools to be used on turning, boring and face operations requiring almost any number of shoulders, as the stops can be so regulated as to give any group of tools or any single tool as many definite stopping points as may be necessary for machining the piece of work.

In the halftone illustrations of different operations in progress, the six cross-slide stops are plainly seen at the front of the turret and in certain of the views the longitudinal stop bars are also visible. The arrangement of these stops and the method of controlling them will be described at another place in this article.

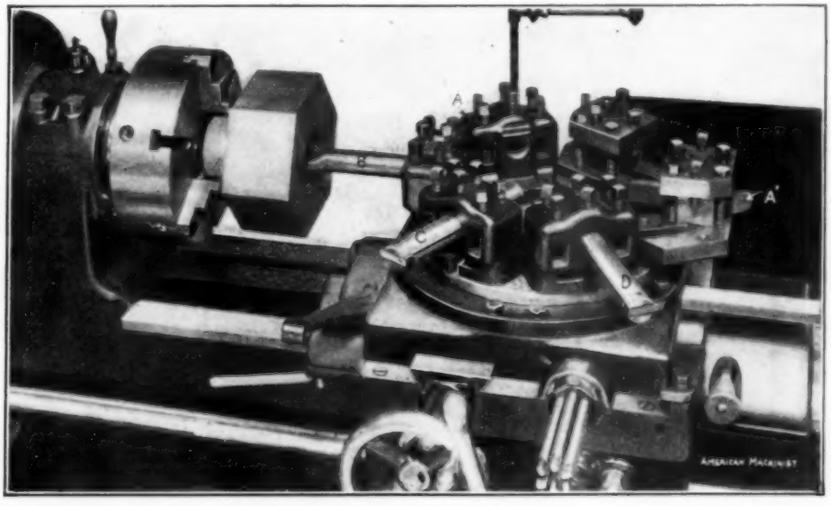


FIG. 1. MACHINING A HEXAGONAL TURRET ON THE COMBINATION TURRET LATHE

MACHINING A TURRET

Figs. 1 and 2 illustrate the method of machining the face, bore and hub of a hexagonal turret, which is part of the Acme 1½-inch screw machine, and the dimensions of which are given on the sketch, Fig. 3.

The first operation, Fig. 1, consists in gripping the casting by the hub in the three-jaw chuck, facing the outer and rear surfaces and machining the bore.

A simple forged tool in holder *A* is first used to rough off the face of the turret *a*, Fig. 3, then the hole is rough bored with tool *B* to two diameters *b c*, Fig. 3, then finished to size with tool *C*, Fig. 1, which is also used to bore out the 2¼-inch recess at the mouth of the bore through the hub. Tool *D* is then run through to the back and used for facing at the end of the hub at *d* to enable a clamping washer to be applied to that surface when the turret is mounted the other face out in the second operation. The last cut in the first operation is with tool *A'*, Fig. 1, which finishes the face of the turret.

THE SECOND OPERATION

The faceplate, Fig. 2, carries the turret for the second operation. The work is located on a disk secured in the faceplate, and is held by a bolt and a nut, which bears upon a washer on the spot faced at the inner end of the hub in the first operation.

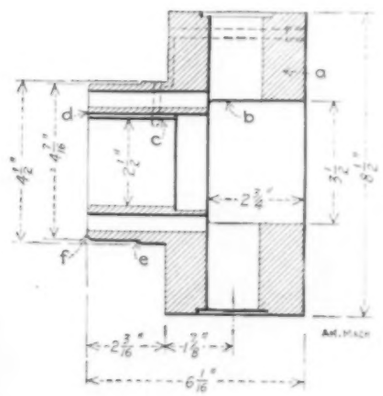


FIG. 3. TURRET TO BE MACHINED

Tool *E*, Fig. 2, rough turns the hub *e* (Fig. 3), and tools *F* and *G* carried in a double block, rough the end of the hub at *f* and the bottom face *g* of the turret at the same time. At the next position of the turret tools, *E'* and *G'* finish these

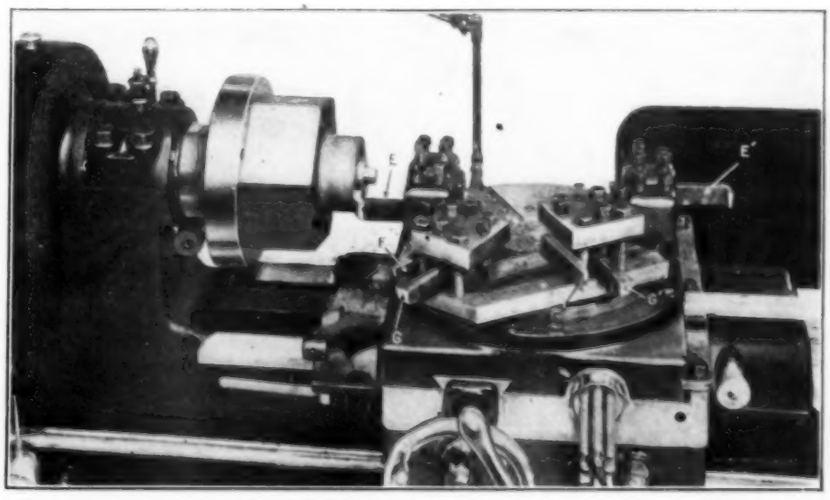


FIG. 2. SECOND OPERATION ON TURRET

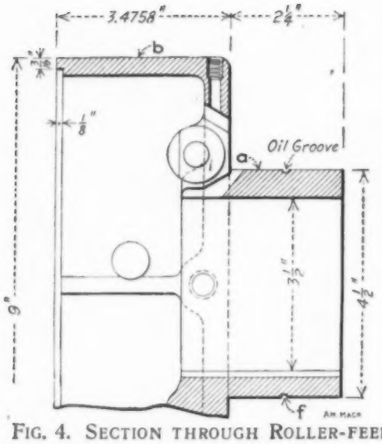


FIG. 4. SECTION THROUGH ROLLER-FEED BODY

two surfaces and tool *E'* is then applied to finish the hub *f*, thus completing the operations performed on this machine.

HANDLING A ROLLER-FEED BODY

The drawing, Fig. 4, is a section through the body of the roller feed, used on the combination turret lathe. Figs. 5 and 6 show the operations in machining this casting with the turret tools.

In the first operation, Fig. 5, the casting is gripped with the jaws inside the shell, and tools *A* and *B* in one holder are applied for roughing hub *a* and body body *b* (Fig. 4), then *C* and *D*, Fig. 5, simultaneously rough face the end of the hub and the under side *d* of the body. Tool *E* in the third station of the turret rough bores hole *e*, and at the same position of the turret tool *F* in the same holder, is fed into the hub to cut the oil groove *f*.

The fourth tool holder carries the second boring tool *E'* for finishing the bore *e*, and the next holder has two tools, *C'* and *D'*, for finish-facing the end of the hub and the broad face *d* of the casting. The last position (which is illustrated in Fig. 5), brings finish-turning tools, *A'* and *B'*, into service for the outside diameters of the case.

Tools like *B* and *B'* are used for both outside and internal work, as required, and, as will be noticed, such tools are shown in different views in various turning and boring operations. The cutters are held by headless setscrews, and an easily adjusted and neat arrangement is the result.

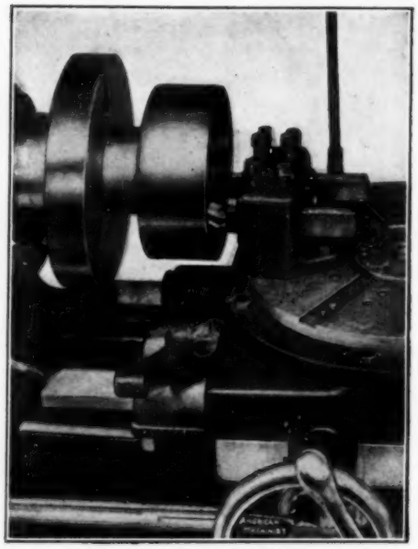


FIG. 6. SECOND OPERATION ON ROLLER-FEED CASE

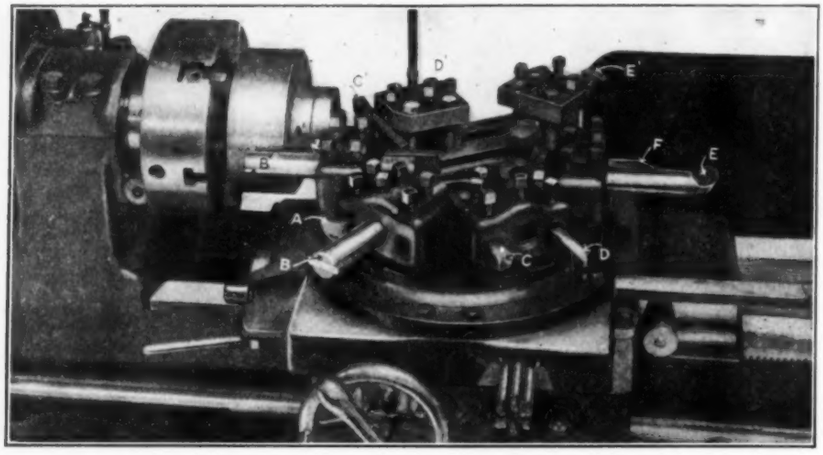


FIG. 5. MACHINING A ROLLER-FEED CASE

FACING THE END OF THE CASTING

Fig. 6 represents the second operation on the roller-feed body, which consists merely of locating the casting on a hub or disk on the faceplate, fastening it with nut and washer on a bolt put in from the rear, and bringing up one tool holder on the turret, in which two tools are carried. One of these is a round nose and roughs off the edge of the casting; the other is a square point and is first used to cut out the recess in the edge of the rim by setting to a diameter stop and feeding straight toward the head against

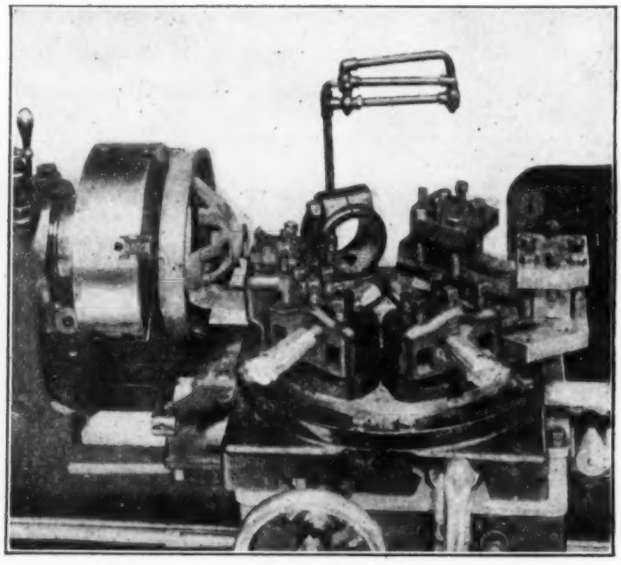


FIG. 7. A FRICTION IN THE CHUCK

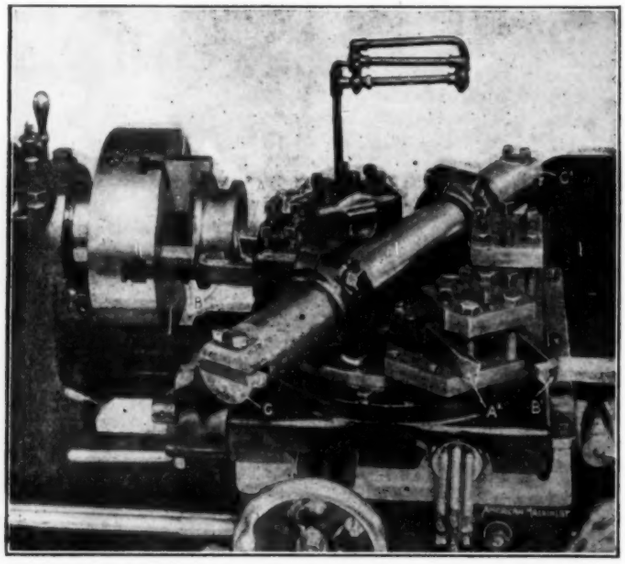


FIG. 8. MACHINING A PECULIAR GEAR RING

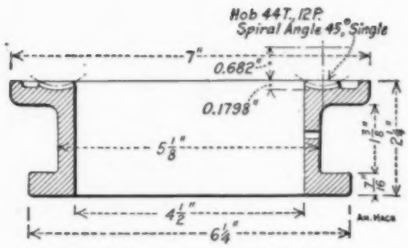


FIG. 9. SPIRAL SPACE GEAR

a longitudinal stop. Then the same tool is run back and fed across the endge of the rim, as illustrated, to finish that surface.

A COUNTERSHAFT FRICTION

In Fig. 7 the machine is set up for the first operation on a cone friction ring for a countershaft. The ring is nearly 12 inches in diameter, and owing to its shape, must be held with some care, in order not to distort it. It is gripped internally near the arms, and while so held, is faced at the back of the rim and at the end of the hub with the two tools seen in operation in the halftone. The two tools in the next two holders rough and finish the bore. The other tool holders on the turret are not required on this piece of work.

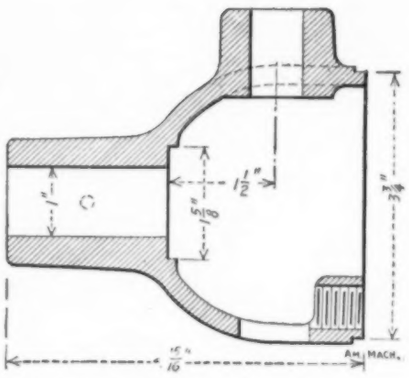


FIG. 11. SECTION OF FEED BRACKET

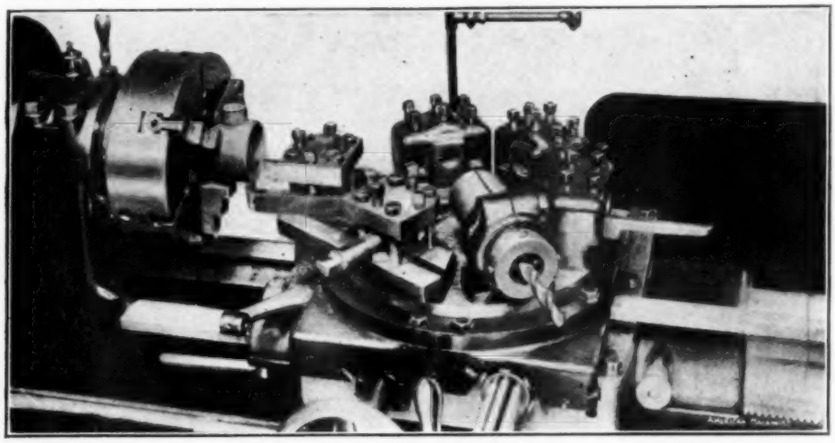


FIG. 10. MACHINING A FEED BRACKET

For the second operation there is a special tool (not shown), which is provided with a cross slide at an angle to feed a single-point cutter across the bevel face and thus finish the rim of the friction to the exact angle requried.

A PECULIAR GEAR RING

The ring in the chuck in Fig. 8 is a part of the roller-feed mechanism, and when completed will have a spiral gear hobbed in its face. The ring is shown by Fig. 9. Tool *A*, Fig. 8, first rough faces *a*, Fig. 9. Bent tool *B*, in the same holder, rough turns and faces the diameters and surfaces *b*. Tool *C* roughs out the bore. The finishing cuts are taken with tools *A'*, *B'* and *C'*.

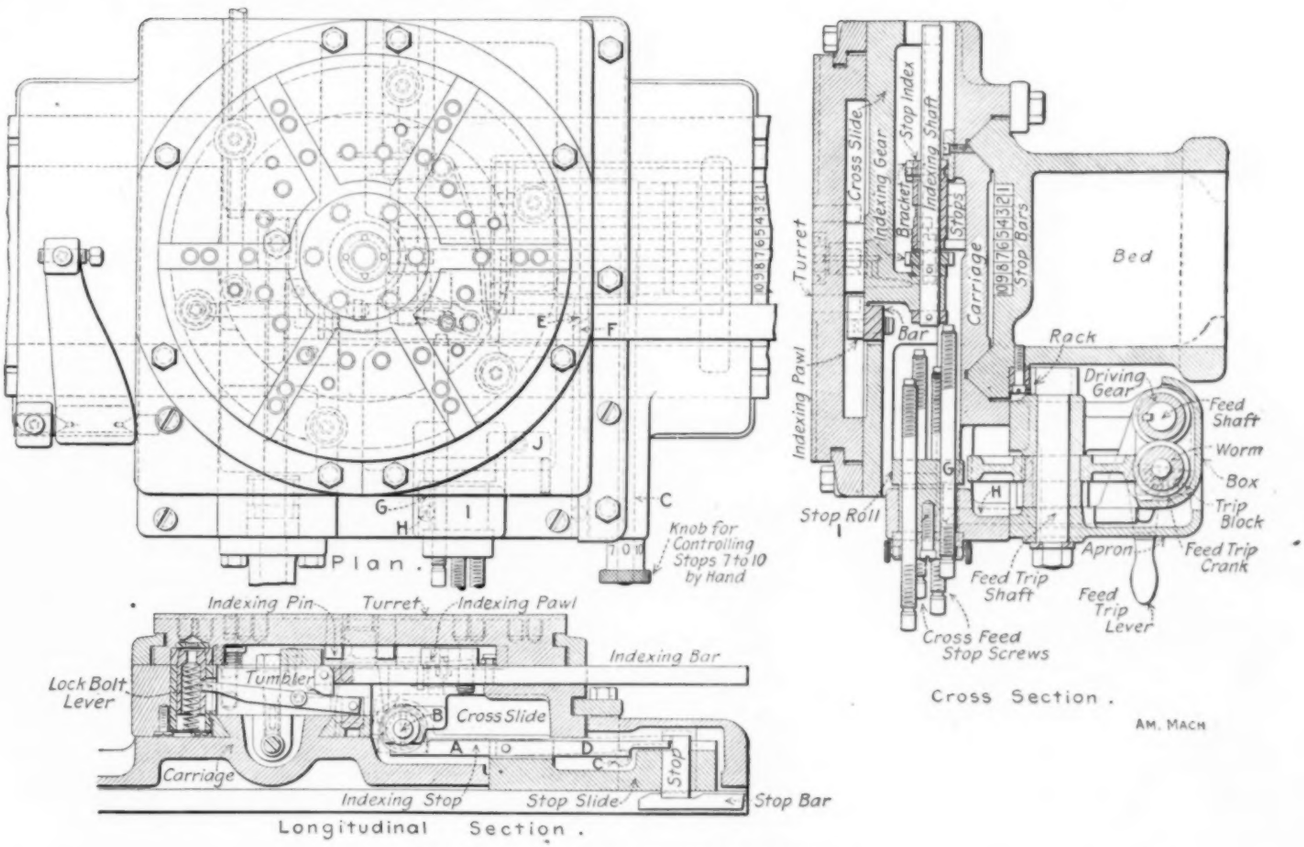


FIG. 12. CARRIAGE AND TURRET MECHANISM

In the second operation the ring is placed, the other face out on a plug in the faceplate and secured by straps on the flange *b*. While held in this fashion, the large flange is roughed and finished on diameter and face.

Machining a Feed Bracket

The casting in the machine in Fig. 10, is a feed bracket for a turret machine, and has to be faced and turned on the open end and also bored out and faced inside, as represented in the section Fig. 11.

Four tool holders are required in the first operation. The first of these carries two tools, which are seen at work on the casting. The bent tool in this holder turns the outside diameter at the end and the straight tool faces the end of the piece. The tool in the next holder toward the front of the turret is run in to face the 1⅝-inch seat at the mouth of the bore through the hub. A twist drill is next passed through the hub and a single-point boring tool follows. The bore is hand reamed after the work leaves the machine.

The Carriage and Turret

Referring now to the turret indexing mechanism and the system of stops for controlling the cutting tools on both longitudinal and cross feeding movements, these features are illustrated in Fig. 12 which presents plan and sectional views of the carriage with the names of the various parts included.

As the carriage is run back along the ways the lock bolt is withdrawn from its seat in the under face of the turret by the lock-bolt lever which is depressed by the tumbler on the forward end of the indexing bar. This tumbler acts upon a roll at the side of the lever and after depressing the lever and withdrawing the lock bolt the tumbler swings free on the indexing bar. The carriage continuing its travel toward the rear end of the bed brings one of the turret indexing pins against the end of the pawl on the indexing bar and the turret is thus rotated to its next station where it is again positioned by the spring-controlled lock bolt. When the carriage is fed forward after this indexing movement, the tumbler pivoted on the side of the indexing bar is swung upward by the roll on the lock-bolt lever and upon clearing the roll it drops to operative position as indicated in the drawing.

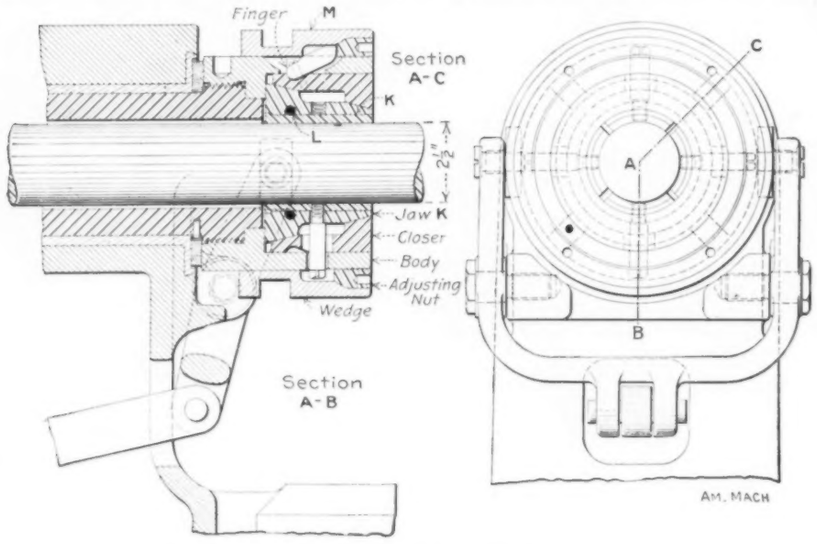


Fig. 13. Section through Automatic Chuck

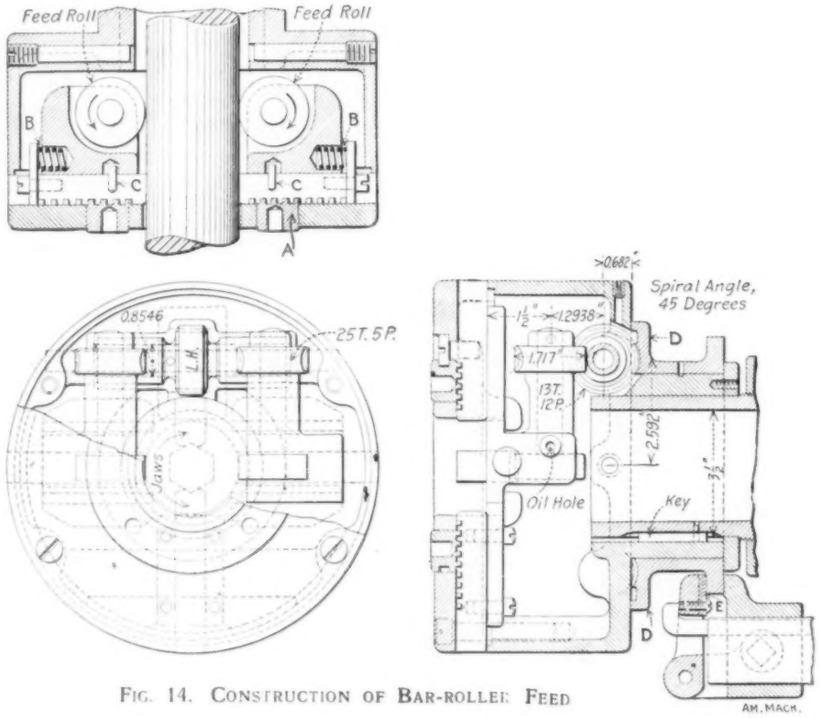


Fig. 14. Construction of Bar-roller Feed

The Carriage Stops

There are ten stop bars for the carriage and six of these are brought into service automatically, one for each station of the turret. Referring to the cross-sections through the stop system it will be noted that over stop bars, Nos. 1 to 6, there are suspended six abutments which are marked "indexing stops." These are supported normally out of contact with the stop bars by a series of levers *A* that are acted upon by cam surfaces on a sleeve *B* carried by the indexing shaft. The sleeve is rotated by the turret through a pair of spiral gears and thus the set of stops is indexed in unison with the turret.

The four additional stops 7 to 10, are controlled entirely by the nurled knob at the front of the carriage as shown in the plan view. This knob actuates a small shaft *C* which supports short levers *D* and which is flatted at four points about its circumference to allow any one of the four levers and stop abutments to drop into contact with the corresponding stop bar. The fifth position of the controlling shaft presents an unflatted surface to the levers and holds the series of four stops out of contact with the stop bars.

The four-hand controlled stops increase the range of usefulness of the different turret tools, as any one or all of them may be used for regulating the movements of any turret tool, and thus a single tool can be applied with accuracy to one shoulder after another or to different faces if desired.

The Automatic Feed Release

The series of stops are carried in a bracket which has a slight amount of longitudinal freedom and when any stop in the group engages with its stop bar the

bracket is prevented from traveling further forward, with the result that a wedge-shaped plug affixed to it at *E* is engaged by a rod *F* in the carriage and the inclined surface on the end of this rod causes it to be pushed outward. This movement is transferred through a wedge-shaped member to a vertical rod (called the "feed-trip shaft") and the feed-trip block being swung downward and to the rear by the depression of this rod allows the feed-trip lever and the worm box to drop and release the feed motion.

These parts are plainly designated in the vertical cross-section in Fig. 12 and the trip rods for the cross feed, which are practically the same as for the longitudinal control, will be seen at *G* and *H*.

In the cross-feed stop system the six stops are carried in a cylinder *I* and when one of these stops is engaged by the cross-slide abutment in the feeding of the slide toward the front of the machine, the stop cylinder presses rod *G* outward and this forces vertical rod *H* down upon the feed-trip mechanism and causes the worm box to drop.

The cross slide is provided with a positive stop at its central position for locating the turret for bar operations, and when the slide is fed toward the center by power the feed is automatically thrown out before the rigid stop is reached, by the lever *J* which forces the stop cylinder forward and thus causes the feed worm to be disengaged as described above.

Inspection of the vertical cross-section where the names of the parts are given, will reveal the manner in which the two bevel-edge trip blocks in the worm box hold the worm in engagement with its wheel when the hand lever is lifted and allow the worm to drop when the feed-trip shaft is depressed.

The Chuck for Bar Material

The automatic chuck for bar stock up to 2¼ inches diameter is shown in Fig. 13. This chuck is operated with the spindle in motion by a lever at the front of the head, the same lever controlling the roller feed. The chuck jaws have no overhang, and have no end motion when closed.

The form of the jaws is seen at *K K*, and the action of the closer is to force the jaws against their rear seat in the chuck body. When the jaws are released they are held back against the seat by a circular spring *L*. The ring *M* is slid forward by the action of the lever in closing the chuck and the result of this movement is to cause the bevel surface in the ring to force the outer ends of the jaw fingers down against the inner face of the adjusting nut or ring. The fingers are held freely by their screws and when the outer end is forced down against the face of the adjusting ring, their rear ends force the closing ring back hard and the jaws are gripped tight on the bar.

The inner jaws or liners which are made to fit in the master jaws and receive all sizes and forms of material within the chuck capacity, are secured in place by screws which are reached through openings in the outer ring without dismantling the chuck. Adjustment is as readily effected by simply turning the large ring or nut on the end of the chuck body.

Roller Feed Details

The roller feed in Fig. 14 is so constructed that when the scroll *A* is operated with a spanner both rolls and centering jaws are adjusted together. The rolls are carried in brackets that are pressed forward by springs *B B*, as far as permitted by pins *C C*, and when the scroll is turned to close the rolls and centering jaws, the rolls are kept somewhat in advance of the jaws by the action of the springs. Therefore in setting to hold any size of stock, the scroll is rotated until the two jaws touch the work and then the jaws are loosened a trifle, leaving the rolls under the proper spring pressure to feed the stock.

The rolls are driven by spiral gears from the face spiral formed on ring *D*. Normally this ring rotates with the roller feed case and under this condition no rotary motion is imparted to the feed rolls. When the chuck lever is operated after the opening of the chuck, the jaws *E* at each side of the flange on the spiral gear ring *D* hold this ring by frictional contact and by preventing it from turning cause the feed rolls to be actuated and the stock to be fed through the chuck.

Location and Ventilation of Wash Rooms

The location of wash and toilet rooms is one of the most difficult problems in the designing of shop and factory buildings. There are many elegantly equipped rooms which are of very little use on account of inconvenient location and many employers who have provided expensive accommodations of this kind are keenly disappointed when they are not more widely used.

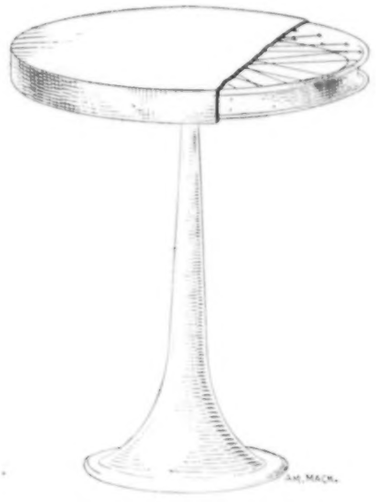
In one particular case a large and expensive wash room was provided which soon fell into disuse because it was so located as to necessitate a walk of about 500 feet for the average man from his position in the shop. As there were no lockers in this room the man had to walk back to his bench after washing up to get his coat and other belongings, making an extra walk of at least a thousand feet or nearly one-fifth of a mile before he could reach home. For this reason many men preferred to go home just as they left their work and perform the scrubbing necessary to transform them back to their original color, after they reached the house.

It would be far better to pay less attention to tiled walls and nickel-plated trimmings and more to convenience of location, thorough ventilation and to the things which will teach sanitary methods.

The ventilation of wash rooms is also often sadly neglected, which is particularly bad when the lockers for clothing are in the same room. Thorough ventilation by mechanical means by which the air is completely changed from 4 to 10 times every hour, is much better in every way than the use of disinfectants. There is probably no part of the plant where thorough cooperation is more necessary than in these departments.

Revolving Stand

In one of the departments of a well known electrical shop, it is necessary to have quite a number of light stands with a revolving top, so that the operator can easily turn which to get at any particular portion of the work. The construction of these stands shows a thorough understanding of one of the first principles of engineering, namely, using materials which are at hand or easily obtainable to secure the desired result at the lowest cost.



Light Revolving Stand

It was an easy matter to buy a number of bicycle wheels from a dealer in second-hand machines at a trifling cost. And by simply screwing one end of the axle into the upper end of a light stand and covering the wheel as shown, a very satisfactory ball-bearing stand was obtained.

In case it was desired to lay light boards or trays on these, instead of using the solid top shown, it is only necessary to put on the wooden rim or tire wide enough to clear the end of the projecting axle, and it can be used in any way desired.

Making Pressed Paper Rolls

By Ethan Viall *

The process of making pressed-paper rolls.

Details of the building-up process, the mandrels, retaining ring locks and pressure used.

The way the rolls are rough turned and finished and the speeds and feeds used.

Rolls used in conjunction with metal ones for calendering ribbon or broad goods of silk, cotton or the like, and rolls used in rotary embossing machines, are made up of disks of felt-like paper, strung on a mandrel and pressed together into a hard, solid mass by hydraulic pressure.

The process is one which few mechanics have an opportunity to witness, but through the kindness of John J. Cavagnaro, Harrison, N. J., maker of silk- and cotton-finishing machinery, we are enabled to show just how the pressed-paper rolls are made.

These rolls range in price from six dollars, to seven hundred dollars each and some are as large as 28x72 inches, taking, in the rough, over two tons of paper.

The idea in using paper instead of steel rolls, is that they give cloth a softer finish than is possible with steel alone, and in the embossing of paper, textiles or other fabrics, the engraved metal rolls leave their impression on the paper rolls so that the material run between them is embossed without tearing at the edges of the impressions.

*Associate editor.

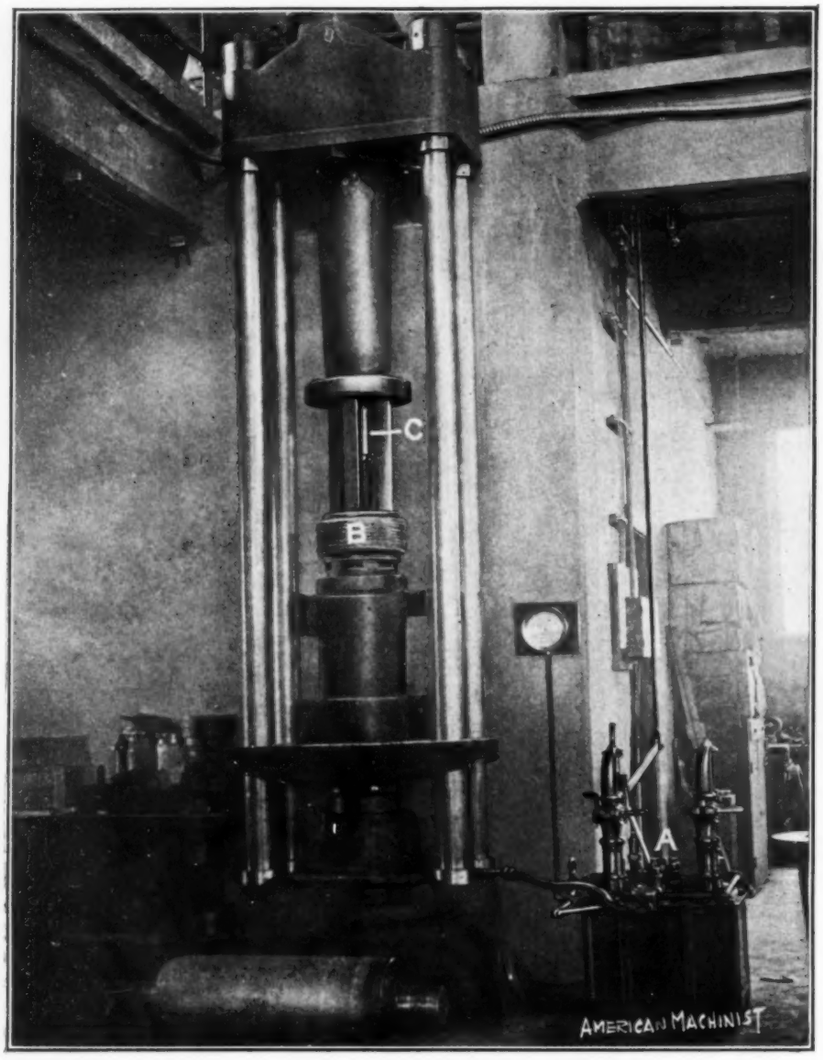


FIG. 1. HYDRAULIC PRESS AND PARTLY PRESSED UP PAPER ROLL

HYDRAULIC PRESS USED

The hydraulic press, Fig. 1, used for pressing up the rolls, is capable of giving a pressure of 1000 tons, though 700 tons is the highest pressure used for any work done in it, the ordinary rolls being pressed up at from 120 to 500 tons, according to size. The pump used to pump the oil into the piston cylinder is shown at *A* and a partly pressed roll is shown at *B*, the end of the mandrel on which it is pressed showing at *C*.

RETAINING RING AND LOCK

An enlarged view of an end of one of these mandrels is shown at *A*, Fig. 2; the key at *B;* lock groove at *C*, retaining ring at *D* and the split locking collar at *E*. A study of the groove, ring and lock, will show that the harder the paper presses outward against the ring, the more firmly is it locked. It will also be seen that as the paper roll is built up to full length, the split locking collar can be easily slipped into the groove in the mandrel, just back of the retaining ring and will keep it in place as the pressure of the hydraulic piston is released.

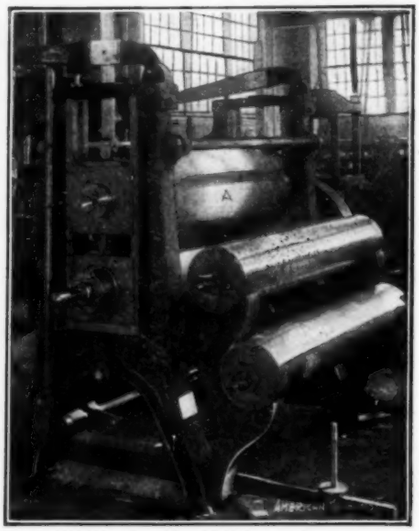


FIG. 5. PAPER CALENDER ROLL IN PLACE ON PARTLY FINISHED MACHINE

ROUGH TURNING THE ROLLS

After being built up to size and the retaining ring locked in place, the roll is removed from the press, placed in a lathe and rough turned as shown in Fig. 3, using a steel tool with a knife edge, shaped

as at *A*, and undercutting and tearing off the rings of paper thus formed.

This cutting is somewhat slow owing to the "gritty" nature of the tightly packed paper and a surface speed of about 60 feet and a feed of 5/8 of an inch per minute, is probably the average.

When the roll has been roughed off, it is finished by using a cup-shaped, keen-edged diamond tool in place of the steel one, the finishing being done at a surface speed of 400 feet and a feed of about 2½ inches per minute.

A rough turned roll, 13⅛x36 inches, is shown in the lathe, Fig. 4, and a rough one just as it comes from the press, lying on the floor, the roll losing about 20 per cent. of its weight in the turning process. These two rolls were pressed up under a pressure of 475 tons, and will last for years.

At *A*, Fig. 5, is a silk calendering roll 16¾x44 1/16 inches, placed in a partly finished machine, the other rolls shown being of chilled iron.

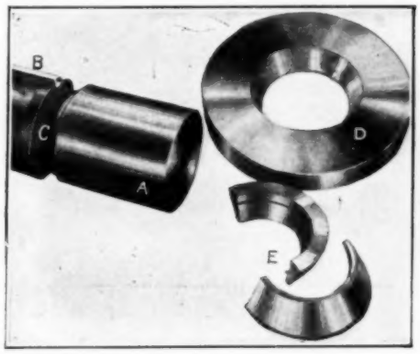


FIG. 2. KEYED AND GROOVED MANDREL, RETAINING RING AND LOCKING COLLAR

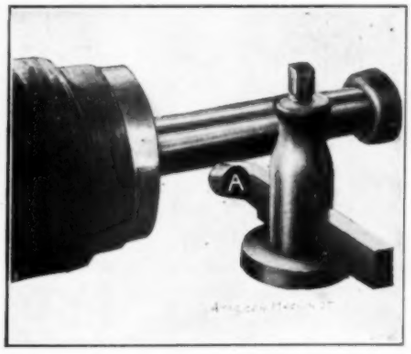


FIG. 3. METHOD AND TOOL USED FOR ROUGH TURNING THE ROLLS

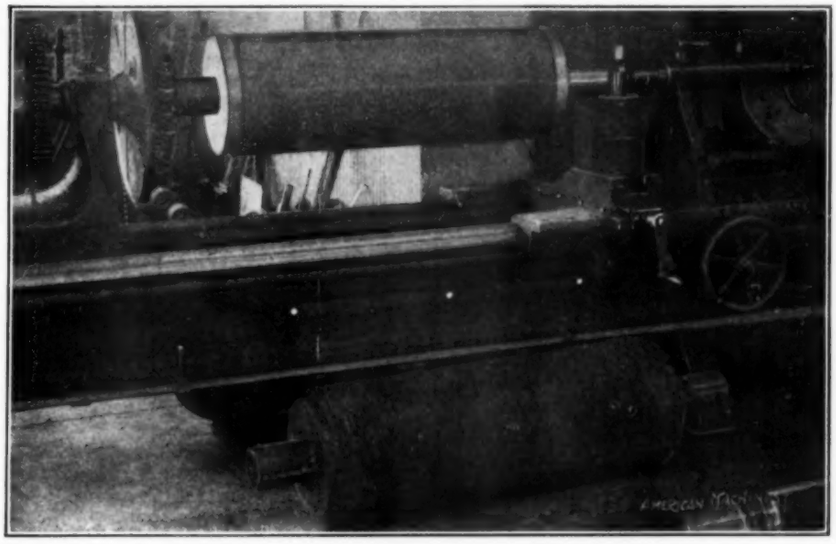


FIG. 4. ROUGH-TURNED AND UNFINISHED ROLLS

From the Squirt Can to the Oil Pump

BY JOHN R. GODFREY

Careful students of machine-shop practice have noted the large percentage of repairs to machine tools made necessary by insufficient lubrication. In fact it was stated some time ago before the Machine Tool Builders' Association that this had been found one of the chief causes of machine tool repairs and that it was largely due to apprentices and operators not being properly instructed regarding the importance of regular oiling.

One does not have to be either very gray or very bald to remember when the oiling facilities on machine tools consisted of a hole drilled through the bearing cap and supposedly reaching to the bearing, and when part of the morning devotion was to insert the nozzle of a more or less antiquated oil can in this hole while we pressed the spring bottom with our strong right thumb.

Next came the cap which slipped over the projecting oil tubes and some of the more careful mechanics inserted a little waste in the tube to keep out dirt. Now, there is hardly a machine of any kind put out without a suitable oil cup for keeping everything out of the oil tube except the nozzle of the oil can and which has greatly aided in preventing cut bearings.

Ring oilers for securing a constant supply of oil to the top of the shaft, which can work its way through the bearing and back into the reservoir beneath, have proved very efficient in many cases, while flooded gear boxes and similar methods have also come into use, as part of the plan to secure constant and efficient lubrication.

But the latest development in the way of lubricating machines that I have seen is the oil reservoir and pump for insuring a continuous flow of oil to all the bearings, as was shown on the Bullard machines at the Master Mechanics Convention at Atlantic City. Here the oil is forced by a pump through pipes leading to each bearing, past an opening so that the operator can easily see whether oil is flowing or not, and so that any stoppage in the passage to the bearing causes the oil to run out of these openings and bespatter the machine and the floor. Even the most indifferent operator will know that something is wrong when he feels the oil over his shoe tops but he will be more than likely to be reminded of the overflow long before this, with a more or less mild reproof from his next-door neighbor.

The only possible failure for such a plan would seem to be from the oil leaking out of the reservoir through an undiscovered or newly developed crack and the operator failing to notice the absence of the oil flow past the openings in the supply pipe.

In a properly lighted shop this would be a very remote possibility, but as we still have much to learn on the lighting question, there are many shops where the operator would require eyes like an owl to see the oil flow even at high noon. In order to provide against this contingency, although it would probably be a greater service to manufacturing and humanity in general to let the proprietor of a poorly lighted shop pay the penalty of his neglect, I would suggest putting some sort of a dufangle in the oil pipes leading to the bearings. The aforesaid dufangle should be so devised as to be swept entirely out of the way by the flow of the oil, but as soon as the flow stops it should drop into place and make connection with some alarm-clock arrangement, operated by the machine, which would warn everybody in the neighborhood that no oil was flowing to one of the bearings.

By having each bearing connected with a different toned bell, it would perform the double purpose of notifying the operator exactly where the trouble lay and also of giving him an elementary musical education, which would make shop life even more enjoyable than at present. The one great drawback seems to be that an over-zealous musician might be tempted to tamper with the flow of oil at the va-

rious bearings in order to periodically produce the Chimes of Normandy or other favorite airs for his own amusement.

But this fanciful improvement is not likely to be needed in any shop where there is sufficient light to show the oil flow past the openings, and no intelligent operator is likely to have the least difficulty, but on the other hand can go ahead with the assurance that the bearings are being thoroughly lubricated.

Features of Modern Lathe Building

By F. E. Reed*

The essentials of lathe manufacture and a plea for simplicity of design.

Unnecessary attachments absorb more power than is usually realized.

Accurate leveling of extreme importance.

*President, F. E. Reed Company.

The modern tendency in lathe building seems to be toward heavy machines and the so called rapid reduction work, almost entirely neglecting the fact that the average lathe work is very little heavier than it was 20 years ago. In the average shop where machine tools are manufactured, all castings and forgings are made as close to finished size as possible and in shops of this kind I do not believe that over 3 per cent. of the work requires excessive cuts.

It is quite true that the advent of high-speed steel makes a much higher turning speed possible but this does not necessitate the extremely heavy and often cumbersome lathes, as the average lathe of the lighter design will handle even the high-speed cuts by simply increasing the speed of the countershafts.

While it is quite possible that there may be cases where an all-geared head is necessary in order to utilize a high belt speed at all times, and to transmit excessive power to the lathe spindle, these cases are few and far between and the cone-driven lathe is not only cheaper to build, but costs less to maintain and consumes much less power. At the same time it gives all the power necessary to do the average run of work in the shop.

Geared Feeds Not Necessary

In lathes where the feed works are properly constructed, I do not consider that there is a necessity for gear feeds in any cases. Where a worm is used in the apron mechanism and a large ratio is secured between the movement of the feed rod and the carriage travel, a feed belt will carry a cut that will slip the belt which drives the lathe. In lathes where the feed works of the apron do not permit a high ratio, in some cases not over 3 to 1, it becomes necessary to drive the feed rod by means of the gearing, because the average feed belt will not drive the feed works at this ratio.

Where a large variety of threads are being constantly cut, the quick-change feed mechanism is a convenience, but on ordinary machine-shop work they are very little used and not only add to the first cost of a lathe but are constantly consuming power in larger proportions than may be generally understood. In any lathe having a quick-change gear feed it is necessary to increase the width of the driving belt on the lathe cone by at least 20 per cent. which gives some indications of the amount of power consumed in the feed box.

And, after all, in the average machine shop which is conducted on a manufacturing basis, it is probably safe to say that 5 per cent. of the lathes could do all the screw cutting for the entire shop in a much more satisfactory manner than is the case where it is more widely distributed. But there are many lathes used in the shop which never cut a thread from one year's end to the other and the lead screw and the change gears are entirely unnecessary.

Spindle Speeds Needed

Where a lathe is to be used on general work, it is probably necessary to have from 8 to 10 spindle speeds. For heavy work, three-step cone and double back gears make a simple and convenient combination, while for lighter work a four-step cone and single back gears answer nearly every requirement. The general tendency toward enlarging the diameter of the cone steps is a move in the right direction and it is advisable to make the lathe head and in fact the whole lathe as simple as possible. For average work three different rates of feed are sufficient and the 60 varieties provided by some of the gear boxes are entirely unnecessary in most cases. In some special instances it may be necessary to have five or six feeds, but I have never known a case in shop practice which required more than this.

The question of accuracy in a lathe is often acked. While comparatively few users require extreme accuracy, a good lathe accurately set up, should not show a variation of more than 1/1000 of an inch in turning a 12-inch bar.

Setting a Lathe Up Properly

Whenever a user, after setting up a new lathe, complains that the lathe does not turn straight, square up true, or bore a straight hole, it is fairly safe to assume in most cases, the lathe bed is strained from being improperly set up. Even the heaviest lathe beds can be sprung when set up out of level upon an uneven floor, and great care should be used to see that the lathe bed is so set as to be perfectly level, and this level maintained, if the lathe is expected to do accurate work.

When lathes are bought to be used on the top floors of high buildings, or in old frame structures, all the hours of time and labor in scraping and lining up the lathes to make them perfectly true, is in large measure of no avail, owing to the fact that no lathes, however well made, will do accurate work, unless they are kept well leveled up.

It is well perhaps that many users of lathes in buildings having unsteady floors, do not require extreme accuracy in this respect, or have the means of testing the accuracy of the lathes they use.

The accuracy obtainable in screw cutting in the average lathe is much greater than necessary in most cases of commercial work, in which the length of the thread cut is usually very short. Where extremely accurate screws are required, as in feed screws, lead screws can be made with an accuracy of 0.001 inch per foot, although such a one is an accurate screw.

Power Transmitted to Point of Tool

The amount of power which a lathe should be capable of transmitting to the point of the cutting tool, of course, varies with the work to be done. In heavy reduction lathes, such as are legitimately used in rough turning heavy forging, the power runs very high, particularly with the geared-head lathe, having elaborate geared feed. In the average cone-driven lathe in commercial work a 12-inch lathe will require about ½ horsepower, an 18-inch lathe 2 horsepower and a 24-inch lathe 5 to 7 horsepower. While there are no exact data as to how much of this power is wasted in bearings and gearing, in other words, what the efficiency of the lathe is, I should expect to find the loss from 3 to 5 per cent.

As the most wear comes on the front bearing of the lathe spindle and on the lathe bed, these should have more careful attention than is sometimes the case. Where the bearings are made of sufficient size, which in my judgment is from ⅛ to ⅙ the diameter of the swing for the front bearing, and a suitable ma-

terial is used for both the spindle and the bearing, there will be very little trouble.

While the most wear comes on the front bearing and the lathe bed as before stated, the weak spot in the average lathe is in nearly every case the feed works first and the stress of the carriage second. This being the case, it seems very plain that the simpler and more substantial these parts can be built, the better will be the results, both in the work obtained from the lathe and the cost of maintenance.

I have been studying lathe construction almost constantly for the last 45 years, keeping myself as well informed as possible with regard to the lathes of all the different manufacturers of this country and the best made in Europe, and I find it is the universal practice among the best builders of lathes, both in this country and abroad, to construct their lathes in such a manner that the least amount of power will be wasted in the driving of the lathe. In other words, most of the power transmitted to the lathe, by the belt or motor, should be available for doing any work the lathe is called upon to perform.

It is a source of surprise to me to see how this point is overlooked by some of the lathe builders, who seem to consider that the larger the motor they can put on a lathe, the better it is. It seems to me to be going to an unwise extreme in using an excessively large motor, or a belt twice as wide as would be necessary with lathe of simpler design and construction.

Caster Wheel Driller

Special Correspondence

A machine that solved a drilling problem by furnishing several times the number of pieces forming the capacity of the machine it displaced. The methods of handling the work are rather unusual.

In making caster wheels, it is imperative that the drilling of the shaft hole in the wheel be done as rapidly as possible. A special seven-spindle driller, recently designed for this purpose by the Hoefer Manufacturing Company, Freeport, Ill., has many interesting features.

Fig. 1 shows the size of the caster wheel. Fig. 2 gives a general idea of the construction of the driller. The line drawings make the details clear. The lettering of the same parts shown on different drawings is the same. Fig. 3 is the side elevation of the machine from the operator's position. At the ends of the bed *A* are two upright arms *B B*, which carry the stationary shaft *C*. This shaft *C* is the central axis about which the entire drum of seven spindles revolves; the shaft also carries the adjustable feeding cam *K*. The entire drive for all seven spindles is obtained through a large three-step cone *D* and back gearing.

A stud on the large gear *L* extends through the bearing of the casing and

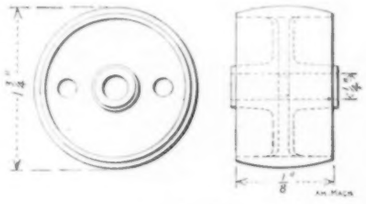


FIG. 1. THE CASTER WHEEL

engages a gear of the back-gear series. Into the gear *L* there mesh seven phosphor-bronze gears, *N* 1, *N* 2, etc., one for each of the seven spindles, Fig. 4. These bronze gears have integral sleeves which set as bearings in the two halves of case *M*. In these sleeves are firmly fastened the driving keys for the spindles, which slide back and forth when feeding and returning.

The spindles, *Q* 1, *Q* 2, etc., Fig. 5, are made of crucible steel and are accurately ground. A threaded section on each spindle provides for different lengths of drills, thus making the spindle adjustable; also, with the lock nut it acts as the thrust for the spindle drive. A steel sleeve with a collar fastened by a headless setscrew is equipped with an elliptical bronze bearing and carries all the thrust of the feed.

The feeding mechanism is especially interesting. Bronze rings are pivoted to the arms *R* 1, *R* 2, etc., by means of cone point setscrews with lock nuts. The end of this feeding arm near the shaft has two half-elliptical lugs cast on each side, which hook under a milled and turned ring that fastens to the plate *S*. This plate contains the seven bronze sleeve boxes for the spindles. This feeding arm has a long roller, which rides on cam *K*. To guide the feeding lever properly, the curved steel plates *V* 1, *V* 2, etc., are rigidly fastened to the case *M*. The requirements of the problem necessitate a feed varying from 1 to 2 inches. The cam *K*, Fig. 5, sliding on the shaft with the long roller follower, gives the most satisfactory results. This cam gives the drill a uniform feed, with a rapid return of such magnitude as to

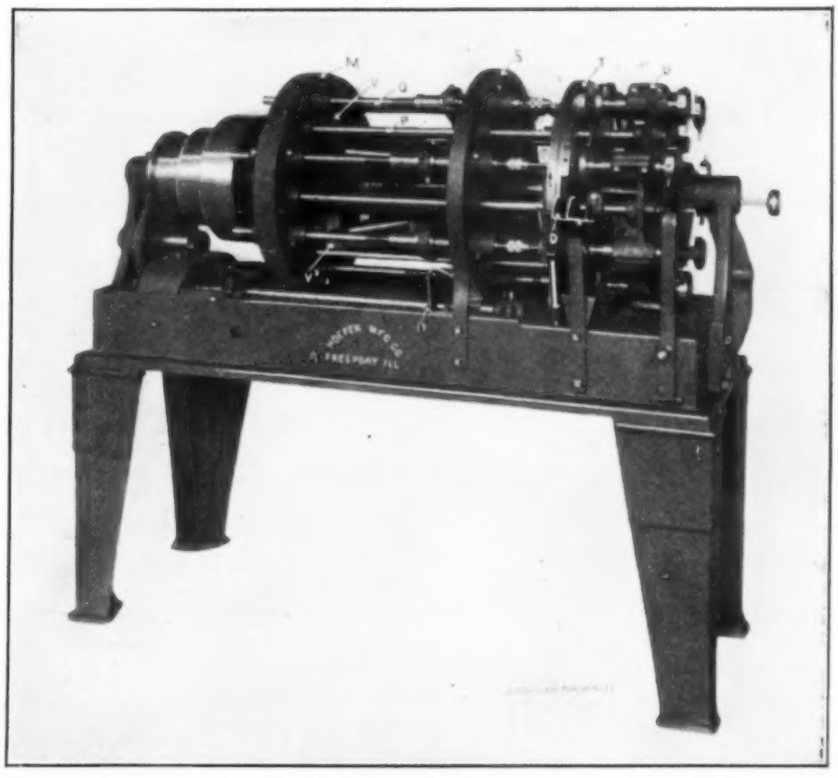


FIG. 2. A SPECIAL SEVEN-SPINDLE CASTER-WHEEL DRILLER

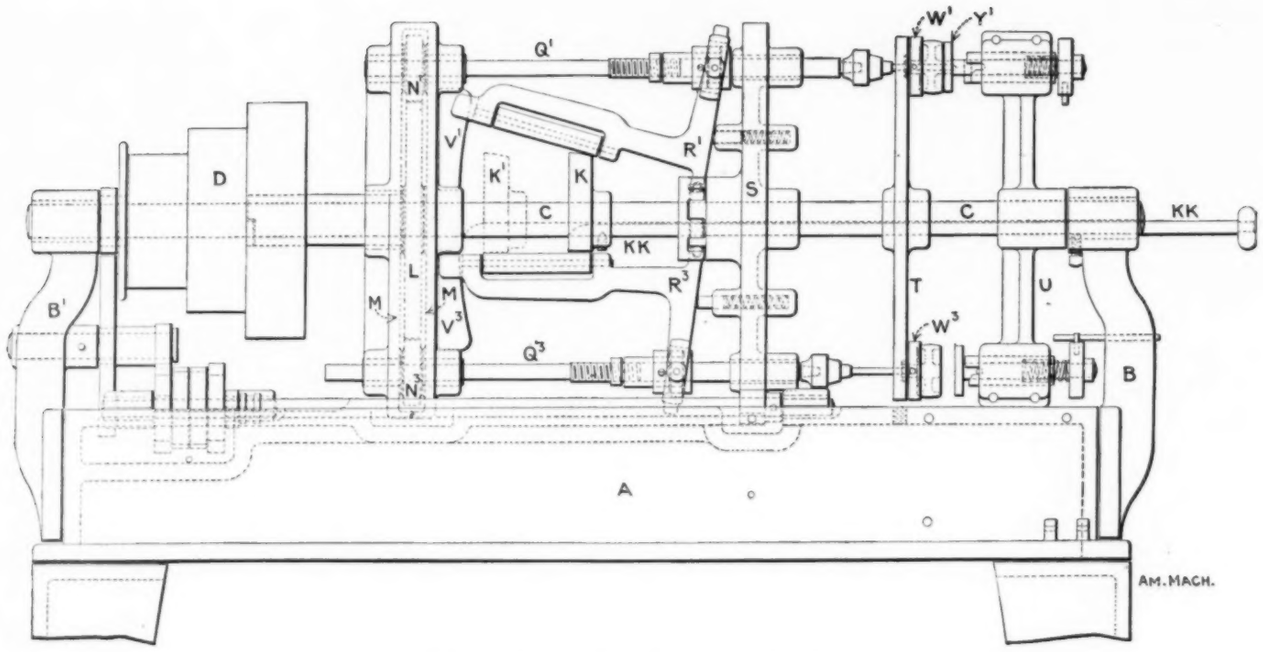


FIG. 3. ELEVATION FROM OPERATIONS SIDE

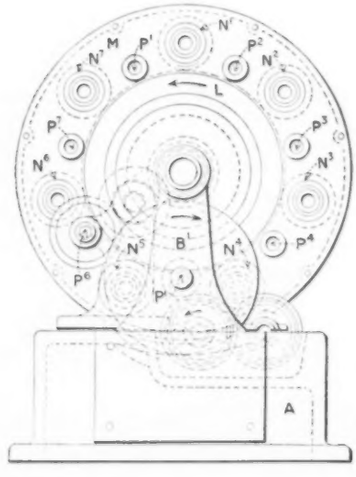


FIG. 4. THE SPINDLE DRIVE

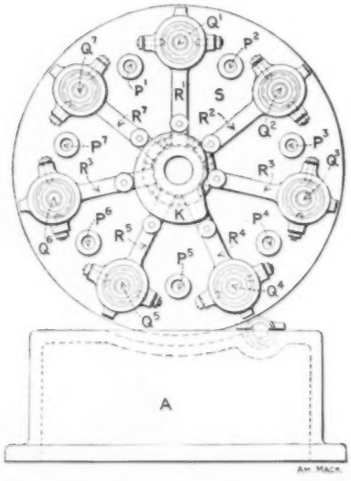


FIG. 5. THE FEEDING CAMS AND ARMS

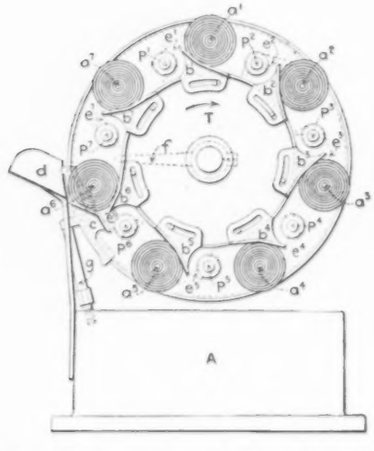


FIG. 6. RECEIVING AND CUTTING ARARNGE-ING ARRANGEMENT

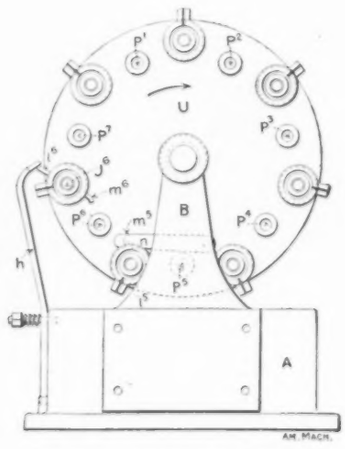


FIG. 7. AUTOMATIC GRIPPING MECHANISM

clear fully the caster wheel, as it is released from the machine, and with a short, rapid advance until the drill point almost touches the new caster wheel to be drilled.

In the stationary shaft, Fig. 3, there is milled a long, deep slot, in which the square rod *K K* is moved. To one end of this rod, the cam *K* is attached, while at the other is a knob, for making the cam adjustments. After the feeding cam *K* has been set, a handle setscrew clamps rod *K K* in position.

The plate *T* carries all the drill guide bushings and also has the circular plates *W*1, *W*2, etc., in which grooves are cut to conform to the diameter of the caster wheels. These grooves accurately center the caster wheels. Plate *U* carries the final clamping parts *Y*1, *Y*2, etc., of the jig attachment for the wheels.

In Figs. 4, 5, 6 and 7, rods *P* 1, *P* 2, etc., connect the gear case *M* with the driving feed gear *S* through which the revolution of all the spindles around the central axis is accomplished, Ferris-wheel fashion. The four plates on the central axis are rigidly coupled together and rotate as a unit.

Upon the speed of rotation of the entire drum of spindles around the central axis, and, of course, the length of feed, depends the feeding in thousandths of an inch per revolution of the drill. The limits of feeds are from 1 to 2 inches in order to keep the drills working near their maximum economical feed. The driller is equipped with a four-change geared feed.

An excellent device is used for receiving, centering, and automatically gripping the caster wheels. As the machine can drill from 20 to 30 a minute, or one in a

little over two seconds, the operator's time is well taken up with just feeding the wheels into the machine. Hence, his motions have been simplified to putting the wheels into a spout.

Figs. 6, 7 and 8 show these designs completely. Plates *T* and *U* carry the guide bushings for the drills. *T* also carries a set of seven grooved plates *a* 1, *a* 2, etc., shown in section at *a* 1, Fig. 8. Concentric circular grooves in these plates just fit the various sizes of caster wheels. This makes the centering process exact after the wheels are located by the guides *b* 1, *b* 2, etc. The guide slides in a groove in plate *T*. The location is fixed by a cap screw. Of course, the single, fixed guide *b* 1 alone would not answer, but with the adjustable guide *C*, the proper *V*-opening is secured for correctly centering the wheels. This guide slides in the outer groove in plate *T*.

The operation of putting a caster wheel into proper position will now be described. The spout *d* is rigidly fastened to the machine, and the right-hand side of the spout, as the operator faces the machine, is adjustable for different widths of the wheels so that the wheels as they roll down the spout into the machine, will maintain their upright positions. The positions of *b* 6, *c* and *d* are correct for the entry of a caster wheel for spindle *Q*6 to drill. As the wheel rolls into place, the two guides *b*6 and *c* properly center it. The entire drum of spindles continues its slow rotation of between three and four revolutions per minute. The swinging dog *e*6 is held in its present position by a spring not shown.

As the drum continues to revolve, the dog *e*6 picks up *c*, still in its correct position for the proper centering of the caster wheel, and carries *c* with it. The dog strikes against an adjustable setscrew on *c* which provides for its proper adjustment. The dog *e*6 carries the sliding guide *c* just long enough to allow the clamping device to grip the wheel firmly. Then, as it continues on its revolution about the shaft *C*, the dog *e*6 strikes the lever *f*, which can be set for any position, and the sliding guide *c* is released and drops back onto the adjustable stop *g*.

However, during the rising of *c*, no wheels can enter the machine, even though they be in the spout *d*, because a part of *c* is a shield that holds the wheel in check until *a* 5 is in a position to receive it. Then the entire process is repeated. As the entire drum revolves with each disk filled, the cam *K* causes the spindles *Q* 1, etc., to feed and drill the wheels.

The final automatic gripping mechanism is shown in Figs. 7 and 8, for which a separate lettering will be used. In Fig.

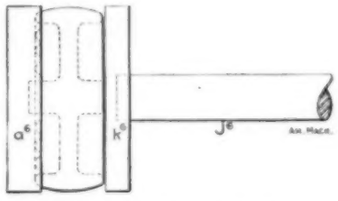


FIG. 8. HOW THE CASTER IS GRIPPED

8, the shaft *j* 6 has on its end a hardened and nurled steel plate *k* 6, which holds the caster wheel firmly in place while the drilling is being done. On the opposite ends of *j* 6, Fig. 7, are two pins *l* 6 *m* 6 fastened in a disk. Pin *l* 6 is engaged by the spring steel arm *h*, which as the drum rotates causes the shaft *j* 6 to rotate. This rotation forces the shaft *j* 6 forward over a cam fastened on the sleeve in which *j* 6 rotates.

This advancing motion is continued until the plate *k*6, is firmly against the caster wheel, at which time the arm *h* is forced to ride over the pin *l*6. Any tendency of the caster wheel to turn thus tends only to tighten the grip on it. Now, as *j*6 completes its revolution around shaft *C*, it comes to the place where arm *n* engages pin *m*6, which automatically releases the cam. The caster wheel drops into the hopper and leaves the holder free to receive a new wheel.

Testing Automobile Axles and Cranks

Two views in the testing room of the E-M-F Company show the machines and the methods used in testing axles and crank shafts. In Fig. 1 an axle is being twisted to show the toughness of the metal.

In Fig. 2 a crank shaft has just been twisted off, the end being shown in the chuck at the right. Registering instruments show the amount of strain necessary to perform these operations, so that the strength of the material is known. As can be seen in the left, an alternating motor is furnishing power for the machines through the Maximum silent chains running on the shrouded pulley with a comparatively short center distance.

It frequently happens that it is necessary to know the diameter and pitch of the thread in a nut or similar piece, and it is neither pleasant nor easy to measure this in the case of a small hole. Some tap makers cast an expanding metal into the hole and then unscrew it. By reinforcing this with a small square piece of steel set in the hole before casting, this can be unscrewed without difficulty. A good expanding metal is bismuth 2 parts, lead 1 part and 1 part of tin.

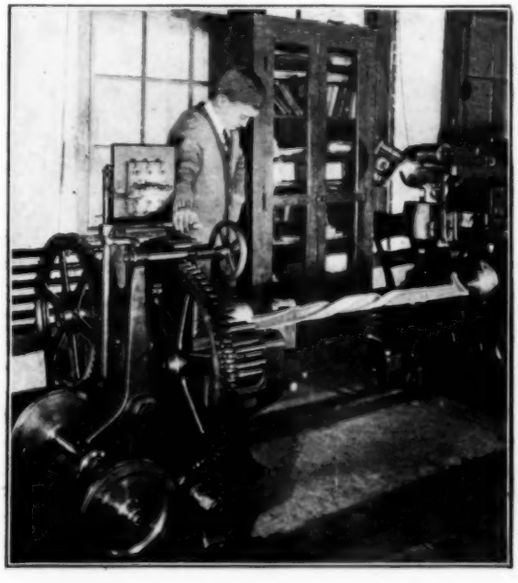


FIG. 1. TESTING TOUGHNESS OF ACTION BY TORSION

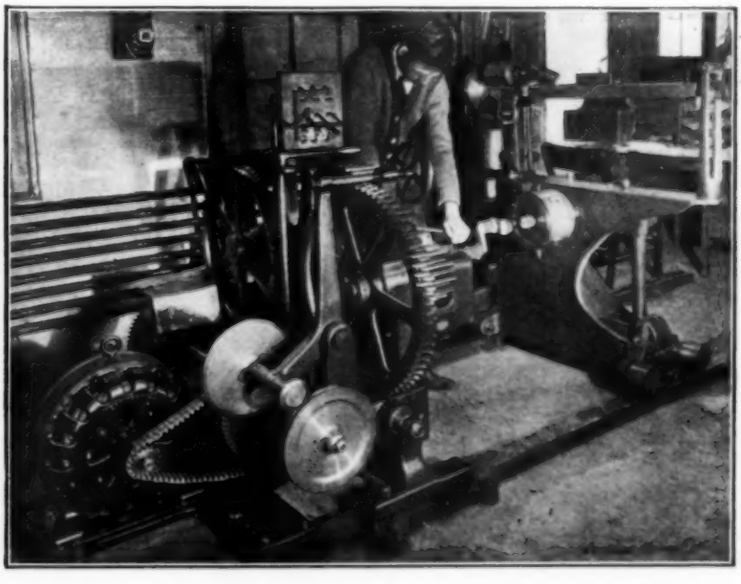


FIG. 2. TWISTING OFF A CRANK SHAFT

Has "Scientific Management" Science?

By A. Hamilton Church*

A study of "The Principles of Scientific Management" leading to this conclusion: "After carefully dissecting Mr. Taylor's writings, one is forced to the inevitable conclusion that the term 'Scientific Management' has nothing tangible behind it, apart from certain very useful mechanisms which Mr. Taylor has done great service in bringing to general notice."

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Eight years ago, at the spring meeting of the American Society of Mechanical Engineers, Mr. Taylor presented a paper on "Shop Management," the first words of which are: "The writer's chief object in writing this paper is to advocate the accurate study of 'how long it takes to do work,' or Scientific Time Study as the foundation of the best management." In the course of years this definite and modest claim has been expanded, until today Mr. Taylor and his associates have put themselves forward (or have allowed themselves to be acclaimed without protest) as the inventors or sponsors of a special system of industrial administration which they term "Scientific Management," thereby obviously implying that all other management is unscientific.

What Is a Science?

A science is a perfectly definite thing. It consists of a long series of ascertained facts connected by tried theories that have stood the test of time and criticism. In an established science personal authority goes for very little, but logical proof counts for a great deal. Whoever undertakes to speak in the name of science must be prepared to prove his right to do so up to the hilt, however wide his experience or however great his reputation. In the present case the matter is one of more than ordinary importance, since Mr. Taylor appears to claim that he and his associates are the special repositories of this science, which cannot be successfully applied without their assistance.

This claim is such a remarkable and unusual one on the part of any body of men claiming to be exponents of technical progress, that we must first of all make sure that it has been clearly and unmistakably made. That it has been made the following extracts will show:

In paragraph 296 of "Shop Management"—"The first step after deciding on the type of organization should be the selection of a competent man to take charge of the introduction of the new system, and the manager should think himself fortunate if he can get such a man *at almost any price.*"

In the Art of Cutting Metals, page 26, we read:

"In fact, the correct use of slide rules involves the substitution of our whole task system of management for the old-style management, as described in our paper on 'Shop Management.' This involves such radical, one might almost say such revolutionary changes in the mental attitude and habits both of the workman and the management, and the danger from strikes is so great and the chances for failure are so many, that such a reorganization should only be undertaken under the direct control (not advice, but CONTROL) of men who have had years of experience and training in introducing this system."

(Note that the word CONTROL is placed in capital letters by Mr. Taylor himself.)

In Mr. Taylor's latest publication, "The Principles of Scientific Management," he says, on page 132.

"It is not enough that a man should have been a manager in an establishment which is run under the new principles. The man who undertakes to direct the steps to be taken in changing from the old to the new (particularly in any establishment doing elaborate work) must have had personal experience in overcoming the special difficulties which are always met with, and which are peculiar to this period of transition."

And just above, on the same page, he says:

"Inasmuch as the writer has personally retired from the business of introducing this system of management (that is from all work done in return for any money compensation) he does not hesitate again to emphasize the fact that those companies *are indeed fortunate* who can secure the services of experts who have had the necessary practical experience in introducing scientific management."

Naturally, the present writer would be the last to argue against the advantages of employing experts when projects of reorganization are on hand. The position and the value of the expert in such cases is well understood. It arises from the fact that to introduce changes in an organization demands somewhat different qualifications from those which make a successful manager, and further that changing an organization is such a delicate and intricate job that few executives have the time to devote themselves to what is naturally very absorbing work. It is also perfectly true that every reorganization presents a crop of special difficulties—difficulties which the expert with his special point of view and experience in just such matters can overcome much more efficiently than men whose regular business is routine management.

The Demand for Control

But Mr. Taylor obviously means more than this. He demands, in fact, what very few experts would demand, namely; not advice but CONTROL, and he demands this on account of the great dangers otherwise attending the introduction of "Scientific Management" into a plant. If he means anything at all it is that the principles of scientific management are so obscure and their practical application so difficult that an experienced and competent expert is unable to assimilate and apply them without years of experience and training in introducing that particular system.

From what does this obscurity and this difficulty arise? Is there really something so obscure in the ordinary elements of industry, in questions of pay, of giving instructions, of handling stores, of getting work up to and past the tool point, that after eight years of discussion about them, they still remain surrounded by a haze of obscurity through which only very competent and specially trained pilots can guide us? Or does the obscurity lie in the demonstration of what scientific management really is. Does the difficulty arise from conflicting claims and a general vagueness about what the principles are? Few men can be found to agree as to what scientific management really consists in. Some will regard it as time study, some as functional management, some as a particular method of "incentive" by extra pay and some will say that it is not any separate one of these things, but merely means a collection of the best methods and practice of the last two decades.

To clear the matter up we must obviously "appeal to Cæsar." We must obtain a decision from headquarters,—a definition that will set the matter at rest once for all. The means we select for doing so will naturally be a reference to Mr. Taylor's publications on the subject.

The sources from which we obtain a knowledge of scientific management are three, namely: "Shop Management," 1903; the introduction to the "Art of Cutting Metals," 1906; and "Principles of Scientific Management," 1911. If on examining and comparing these authoritative statements we find, consistently, a definite and clear insistence on some central principle, the claim that scientific management is "one, whole, and indivisible" may be admitted, but if we find on the other hand that the stress and emphasis is constantly being shifted from one feature to another, then that claim will not be established.

Definitions of Scientific Management from Mr. Taylor's Writings

The first paragraph (of the index) to "Shop Management" has already been quoted. It states specifically that the object of the paper is to advocate scientific time study as the foundation of the best management. (Here scientific management appears to be identified with time study.)

Paragraphs 92-94 declare that all ordinary systems of management ("including the Towne-Halsey system, the best of this class") are based on "ignorance and deceit." And the statement is made that by accurate time study "surprisingly larger results can be obtained *under any scheme of management* from day work up." (The italics are mine.)

In paragraph 135, "the writer most sincerely trusts that his leading object in writing this paper will not be overlooked and that SCIENTIFIC TIME STUDY will receive the attention it merits. (Capitals are Mr. Taylor's own.)

Up to this point we have a consistent idea, namely, the reduction of all operations to their elements and the time study of these elements by means of a stop watch. This idea is a very old one. It was well known to the early manufacturers in their researches into the proper "subdivision of labor." The use of the stop watch was described by Babbage in his book on "Economy of Manufactures," issued in several editions from 1832 to 1846. This does not, however, detract in the least from Mr. Taylor's rediscovery of the idea, nor from the credit due to him for his persistent advocacy of such an important instrument of industrial analysis. In itself it does not constitute a science. It is merely a very useful method for studying a limited class of facts It is not management of any kind whatever.

Paragraph 21, however, asserts—and the whole paragraph is set in capital letters by Mr. Taylor, to mark its importance:

"THIS PAPER IS WRITTEN MAINLY WITH THE OBJECT OF ADVOCATING HIGH WAGES AND LOW LABOR COST AS THE FOUNDATION OF THE BEST MANAGEMENT, OF POINTING OUT THE GENERAL PRINCIPLES WHICH RENDER IT POSSIBLE TO MAINTAIN THESE CONDITIONS EVEN UNDER THE MOST TRYING CIRCUMSTANCES AND OF INDICATING THE STEPS WHICH THE WRITER THINKS SHOULD BE TAKEN IN CHANGING FROM A POOR SYSTEM TO THE BETTER TYPE OF MANAGEMENT."

In this paragraph a new "chief object" of the paper is declared, and a new element as the "foundation of the best management" is put forward. It hardly need be pointed out that time study has no necessary relation to high wages and low labor cost, and that one is a practical instrument and the other a theoretical aim of management.

With paragraph 148 we enter a new phase of the subject. In this it is declared that management is an art, with four principles: (1) A large daily task. (2) Standard conditions and appliances. (3) High pay for success. (4) Loss in case of failure. A subsidiary principle for future use is added, namely: That the task should be so fixed that only a first-class man can do it. Principle (1), however, appears to be superseded later (in paragraph 191) where the superior advantages of SHORT tasks is demonstrated. The main purpose of the paper appears to be modified once more, and these principles take equal rank with time study as the foundation of management. Time study is in fact relegated to a somewhat subordinate place among 14 or 15 changes necessary to realize the art of management.

In paragraph 232 another principle makes its appearance. It is declared that "a great part of the art of management lies in subdividing duties, and this is to be accomplished by ABANDONING THE MILITARY TYPE OF ORGANIZATION and introducing two broad and sweeping changes into the art of management." (Capitals are Mr. Taylor's own.) These changes are in the direction of what is known as functional foremanship.

The Planning Department Is Management

This idea is given definite shape in paragraph 257 on which the somewhat startling statement is made that

"The shop (indeed the whole works) should be managed, not by the manager, superintendent, or foreman, but by the planning department. The daily routine . . . . . should be so carried on . . . . . that in theory at least the works would run smoothly even if the manager, superintendent and their assistants outside the planning room were all to be away for a month at a time."

If there is any meaning in this statement at all, it certainly seems to infer that the planning department is not only the central feature of the art or science of management, but that it IS management in itself. This is a pretty large order and we seem to have gone a long way away from the original statements,

(1) That time study is the foundation of management;

(2) That high wages and low labor costs are the foundation of management;

(3) That large tasks, standard conditions and high pay are the fundamental principles of management, and have come down to the proposition, virtually, that

(4) The planning department IS management.

Space does not permit of dealing with the 17 elements of the planning department enumerated under the letters *A* to *Q* in paragraph 258. But we may note that *H* is "The mnemonic symbol system;" *K* is "Maintenance of system and plant and use of the tickler" (!!); *L* is a "works postal system" and *O* is a "mutual accident insurance association." These are gravely declared to be among the "leading functions" of the planning department.

This is a very surprising result: The planning department, held up as a creation so powerful and intelligent that it can run the plant without the assistance of the manager or superintendent, turns out to be merely a new group name for a number of administrative activities, some of which, as, for example, *G* the pay department, are as old as the relations of employer and employee.

Either Mr. Taylor has here failed, and very badly failed, to make himself clear, or this is a case of inability to distinguish between broad principles and mere practical devices. Functions *H, K, L* and *O* may be excellent things but that they are worthy of being ranked as fundamentals of management is more than doubtful. Their use is certainly not logically derived from the principles already laid down.

In paragraph 288 yet another principle makes its appearance. This is the "exception principle" which declares that each executive officer should deal with masses of reports and papers in a routine way, but have his attention called by an assistant only to those points which form exceptions to the past averages or standards. This is an excellent idea and is very frequently adopted, and it closes, as far as I have been able to discern, the series of principles selected for adoption in "Shop Management."

The introduction to the "Art of Cutting Metals" need not detain us. It contains little on the subject of management beyond the paragraph already quoted. We will, therefore, turn to Mr. Taylor's latest book, "The Principles of Scientific Management," published this year, and contrast its contents with those extracts from "Shop Management" given above.

Before doing so, however, let us endeavor to understand what the object of the paper on "Shop Management" really was. Although it began by declaring (1) that time study was the all-important thing in management and then went on to declare (2) that high wages and low labor cost was the leading feature, (3) that the art of management really consisted of four principles, (4) that the proper type of management was that known as functional, a specific instance being given of a planning department with 17 subdivisions—the chief idea which Mr. Taylor appears to have in mind was a development of the old principle of the "subdivision of labor." Had he made this the central feature of his paper and developed this idea by itself without tacking on to it so many subsidiary and insignificant details, so much cut-and-dried system, he would have performed a far greater service. But Mr. Taylor was not content to develop principles, he insisted on particular detailed arrangements, and the whole attitude of himself and his friends has been to cry "hands off" to any modification of these details, as if they were absolute and logical developments of some

well defined principle. That they are not is sufficiently obvious from what has already been presented above. That a comprehensive generalization is possible that shall include both time study and functional foremanship, and form a *real working principle* independent of arbitrary details is, I believe, not unlikely, but Mr. Taylor has nowhere given us such a broad and general statement, in the 464 paragraphs of "Shop Management."

The Philosophy of Scientific Management as Set Forth in Mr. Taylor's Latest Writings

Between the appearance of "Shop Management" and the publication of the "Principles of Scientific Management" neary eight years have elapsed—the latter may, therefore, be regarded as the matured presentation of Mr. Taylor's science.

The first chapter entitled "Fundamentals of Scientific Management," is mainly a dissertation on "soldiering." We are told, however (page 28), that the many papers written hitherto on scientific management have mistaken the mechanism for the essence, and a warning is given that scientific management consists of "a certain philosophy which can be applied in many ways; and a description of what any one man or men may believe to be the best mechanism for applying these general principles should in no way be confused with the principles themselves."

This seems hard on those of Mr. Taylor's assistants who after years of association with him have written books and papers on the "system" without, it would appear, being aware of the important philosophy that lies behind it. It is certainly discouraging for the rest of us that have not had this advantage of association, because it would seem to indicate that it is more than ordinarily elusive and mysterious. The only thing approaching the nature of a fundamental in this chapter is that,

> "In almost all of the mechanic arts the science which underlies each act of each workman is so great and amounts to so much that the workman who is best suited to actually doing the work is incapable of fully understanding the science without the guidance and help of those who are working with him or over him, either through lack of education or through insufficient mental capacity."

As a deduction from this, he declares that "to work according to scientific laws . . . . almost every act of the men should be preceded by one or more preparatory acts of the management which enable him to do his work better and quicker than he otherwise would." Also that "close, intimate, personal coöperation between the management or the men is of the essence of modern scientific or task management."

Chapter II, however, does throw more definite light upon what scientific management is claimed to be. It contrasts the older plan of management—which Mr. Taylor calls the "initiative and incentive" plan (meaning that special incentives, piecework, premium, etc. are offered by the management to secure the workmen's interest and initiative)—with the new plan. The latter is declared to be a system by which,

> "The management assumes the burden of gathering all the traditional knowledge which in the past has been possessed by the workman, and then of classifying, tabulating and reducing this knowledge to rules, laws and formulas."

In addition four "new and heavy burdens" are taken on by the management:

An Analysis of the Claims

1. *"They develop a science for each element of a man's work which replaces the old rule of thumb method."*. What this high sounding claim means is not at all obvious. You cannot develop a science out of a single fact, and to say so is a misuse of words. Probably what Mr. Taylor means is that they develop what they believe to be the best practical method of performing each element of a man's work, basing this belief on the data as to performance they have already acquired by time study. That is a very different thing—a very human and fallible thing, extremely liable to errors of judgment, and not possessing any of the certainty and infallibility of "science" at all.

2. *They scientifically select and then train, teach and develop the workman, whereas in the past he chose his own work and trained himself as best he could.* This also is a very wide claim, unless we read into it limitations which Mr. Taylor has nowhere indicated. What is the meaning of the workman choosing his own work? Does it mean his trade, or the particular job? If the former, I think few workmen will change their trades at the bidding of any "scientific" manager. If the latter, then I do not know of any shop in which the workmen scramble for the jobs, or are able to pick and choose what they will or will not do. What Mr. Taylor really means—judging from his practice—is that each workman is made to do the job in a particular way, namely, that indicated by an official in the planning department. I have not been able to discover that this philanthropic-looking phrase means anything more than this.

3. *They heartily coöperate with the men so as to insure all of the work being done in accordance with the principles of the science which has been developed.* Here we have not philanthropy but idealism. The securing of "hearty coöperation" is an excellent idea—if it can be secured. But can it be secured by any system? Does Mr. Taylor claim that he can raise the average of human nature, because if so, and the claim be justified, many more urgent problems than shop management will have been solved. But if "hearty coöperation" is a necessary and inherent ingredient of this method, then practical men will do well to handle it with gloves. The millenium and a number of other things can be realized if hearty coöperation between man and man becomes the order of the day. This is another vague and rhetorical claim, the true meaning of which will be found in the eight separate "bosses" whose behests the man has to follow—and heartily coöperate with.

4. *There is an almost equal division of the work and the responsibility between the management and the workmen. The management take over all work for which they are better fitted, while in the past all of the work and the greater part of the responsibility were thrown upon the men.* Exactly how this fourth duty differs from the preceding duties is not at first reading very obvious. By the time that the workman has had a science developed for each element of his work, has been scientifically selected, trained, taught and developed and then heartily coöperated with into the bargain, there does not seem much more to be done for him by the management. Mr. Taylor seems to have perceived this dimly, as he says that this fourth duty requires further explanation. His explanation is that the development of a "science" requires numerous records and "a room in which to keep the books and a desk for the planner to work at." So that this fourth "new and heavy burden" means mainly an order system to transmit the "science" to the workman.

Finally Mr. Taylor sums up his four duties by remarking: *"It is this combination of the initiative of the workman, coupled with the new types of work done by the management that makes scientific management so much more efficient than the old plan."* It will be seen that this is yet another and totally different definition of scientific management from any before. It certainly makes us rub our eyes with wonder. Having gathered in all the workman's traditionary knowledge, and indexed, tabulated and cross referenced it, so that as stated on page 58, "the records containing the data used under scientific management in an ordinary machine shop fill thousands of pages," having put the workman in such a position that his own personal knowledge is of not the slightest value beside that of the infallible mechanism, the planning department, having provided him with eight bosses (including a disciplinarian) to insure that he does not exercise his personal judgment in the slightest degree—Mr. Taylor calmly talks about scientific management "consisting in a combination of the initiative of the workmen with new types of work done by the management."

No sooner, however, have we become familiar with this definition than we are confronted two pages further on, by an entirely new view of the matter. "Per-

haps," says Mr. Taylor, "the most prominent single element in modern scientific management is the task idea." On examination, the task idea appears to be an old familiar friend, namely, payment by the piece (not necessarily piecework or premium as ordinarily used) with the proviso that,

"These tasks are carefully planned . . . . . that in no case is the workman called upon to work at a pace which would be injurious to his health. The task is always so regulated that the man who is well suited to his job will thrive while working at this rate during a long term of years and grow happier and more prosperous instead of being overworked."

And before we have had time to recover our judgment after the exhibition of this beautiful picture of the happy workingman—who is to receive after all an "incentive" of 30 to 100 per cent. extra wages if he comes up to expectations, Mr. Taylor presents us with yet another definition of scientific management. "Scientific Management," he says, "consists very largely in preparing for and carrying out these tasks." It might almost be said that, apart from the philanthropic motive, which is commendable, but not easy to realize, this is exactly what every advanced type of management consists in very largely also.

On pages 98-99 we have a definite statement of how scientific management was applied to a machine shop "in better physical condition than the average machine shop in this country." The demonstration of the superiority of the new system was made on one machine "by means of four elaborate slide rules . . . . also tools of the proper shape properly dressed, treated and ground," with the result that the gain in time ranged from 2½ to 9 times the original speed of operation. Here scientific management appears to imply simply an accurate knowledge of the "art of cutting metals."

A Confusing Situation

It is hardly too much to claim that all this is a little confusing. I have no wish to offer merely carping and destructive criticism, but probably few people will be found to assert that this is a clear, orderly and systematic development of "principles." Beginning with the essentially simple though very valuable idea of "time study" the claims of "scientific management" have been extended until they include practically every organic element of the mechanism of advanced management. Now this would be understandable if it could be demonstrated that these organic elements were threaded together on some exceedingly improved plan. But nowhere in Mr. Taylor's own writings do we obtain a definite idea of what this special plan is which differentiates his particular method of management from ordinary advanced methods to such an extent as to make it positively *dangerous* to introduce into any plant without the CONTROL of a specially trained man.

To substantiate such a claim much more than mere rhetoric about "developing a science" or "hearty coöperation with the men" is necessary. Neither of these is either a principle or a method. They are simply a statement of two obvious and desirable aims, common in greater or less degree to every advanced management. To have high and desirable aims is good, but it is not a science of management in any sense whatever.

Some people may be inclined to think that this is not fair criticism—that I am selecting portions of Mr. Taylor's demonstrations and leaving out the explanatory and significant parts. To show that this is not so I will quote in full the matured and deliberate summing up presented near the end of his latest book. This will show that after having presented at various times, (1) time study; (2) high wages and low labor cost; (3) the four principles (large daily task, standard conditions, high pay for success, loss for non-success, and very difficult tasks) (4) functional management; (5) the planning department; (6) the four burdens; (7) the combination of men's initiative with new types of management work; and (8) the task idea, ... having presented these elements at various times, each in its turn as the most prominent and essential feature of his system, Mr. Taylor, on page 128, tells us that scientific management is NOT mechanism. he says:

"Precisely the same mechanism which will produce the finest results when made to serve the underlying principles of scientific management will lead to failure and disaster if accompanied BY THE WRONG SPIRIT in those who are using it. Hundreds of people have already mistaken the mechanism of this system for its spirit."

The quotation may be interrupted here to remark that scientific management here appears in an entirely new light, as a spirit. What does this exactly mean? We have been told of the necessity for a spirit of hearty coöperation, and by implication, of the desirability of cultivating the scientific spirit of inquiry, but by no ordinary use of words can a spirit—that is, an attitude of mind—be called a system of management. The cultivation of a particular spirit is the affair of moral and mental science, not a matter of practical management, except in the vaguest theoretical sense. This statement, however, does throw some light upon the necessity "not for advice but CONTROL" on the part of those introducing the system. Because it shows that, after all, scientific management is exactly like every other kind of management, namely: the outward expression of the peculiar and personal temperament—in other words, the spirit—of the manager.

Twelve "Mechanisms" of Scientific Management

Returning to our quotation, we find 12 elements of the "mechanism" of scientific management listed as follows:

(1) Time study, with the implements and methods for properly making it.

(2) Functional or divided foremanship, and its superiority to the old fashioned single foreman.

(3) The standardization of all tools and implements used in the trades, and also of the acts or movements for each class of work.

(4) The desirability of a planning room or department.

(5) The "exception principle" in management.

(6) The use of slide rules and similar time-saving implements.

(7) Instruction cards for the workman.

(8) The task idea, accompanied by a large bonus for the successful performance of the task.

(9) The differential rate.

(10) Mnemonic systems for classifying manufactured products as well as implements used in manufacturing.

(11) A routing system.

(12) Modern cost system, etc.

"These, however," adds Mr. Taylor, "are merely elements or details of the mechanism of management. Scientific management in its essence consists of a certain philosophy, which results, as before stated, in a combination of the four great underlying principles of management."

Even then, after this warning as to the essential importance of the "certain philosophy," Mr. Taylor does not enlarge at any great length on what this philosophy is. Instead, he presents us with a mere footnote of four lines, stating what the four underlying principles of scientific management are, viz: (1) The development of a true science. (2) The scientific selection of the workman. (3) His scientific education and development. (4) Intimate friendly coöperation between the management and the men.

Apart from the fact that these four underlying principles are nearly identical with the "new and heavy burdens" referred to in Chapter II, we are not much assisted in running down and identifying that very elusive "spirit" of scientific management by this footnote. Certainly the first principle that "scientific management is the development of a true science" does not throw much light on the subject. To say that the first underlying principle of a science is the development of that science seems to mean nothing. It is like saying that the first principle of the science of chemistry is to develop the science of chemistry. If we were engaged on a quest to discover what the science of chemistry really was, we should hardly be satisfied with a "principle" of that kind. It reminds one of the individual who asked for bread and was given a stone.

Finally on page 139, Mr. Taylor makes an altogether new definition of scientific management. He says:

"It will doubtless be claimed that in all that has been said no new fact has been brought to light that was not known to someone in the past. Very likely this is true. Scientific management does not necessarily involve any great invention, nor the discovery of new and startling facts. It does, however, involve a certain *combination* of elements which have not existed in the past, namely, old knowledge so collected, analyzed, grouped and classified into laws and rules that it constitutes a science, accompanied by a complete change in the mental attitude of the working men as well as those on the side of the management toward each other, and toward their respective duties and responsibilities. Also new division of the duties between the two sides and intimate friendly coöperation to an extent that is impossible under the philosophy of the old management. And even all of this in many cases could not exist without the help of mechanisms which have been gradually developed.

"It is no single element, but rather this whole combination, that constitutes 'Scientific Management' which may be summarized as:

"Science, not rule of thumb; harmony, not discord; coöperation, not individualism; maximum output in place of restricted output; the development of each man to his greatest efficiency and prosperity."

A Grave Protest

It is in no flippant mood, but in grave protest at this sort of thing being presented to practical men as a business solution of an every-day problem, that I would point out the vague and rhetorical character of these claims, which remind one of nothing so much as the writings of the "benevolent socialist" school of Robert Owen, and the "mechanical projectors" of the last century. What Mr. Taylor describes here, is neither a science nor an art, but simply a set of ethical propositions and moral aspirations. Having disclaimed the "mechanism" of time study, "functional foremanship," etc., as NOT constituting in themselves scientific management he leaves us no wiser than before about what are the steps that should be taken to bring about "changes" in the mental attitude of both sides, and to secure that "intimate friendly coöperation" which is to produce "harmony not discord" and "coöperation, not individualism."

An Inevitable Conclusion

After carefully dissecting Mr. Taylor's writings, one is forced to the inevitable conclusion that the term "scientific management" has nothing tangible behind it apart from certain very useful mechanisms which Mr. Taylor has done great service in bringing to general notice. He has failed to show the path to the very desirable moral aspirations that he voices so eloquently, because he, like the rest of us, has no golden key to change human nature, or to bring about an industrial millennium. He admits on the one hand that there is little that is new in the *practical* elements of his system, and his claim for a new *combination* involves new and intangible elements which not only have never existed in the past, as he admits, but are of such a nature that only the most concise and definite evidence will make us admit their existence in the present. It will take more than a simple claim, even on the part of so eminent a man as Mr. Taylor, to convince the rest of us that, in this imperfect world, he can banish discord, and substitute coöperation for individualism, except in the very limited sense that any well managed system of payment by results covers the same ground.

Even if we were inclined to admit this, Mr. Taylor has wholly failed to give us a glimmering of how it is to be done. He has specifically warned us against imagining that practical methods—that is, mechanism—will lead to anything but "failure and disaster" unless fructified by his "underlying philosophy" and when we come to examine that philosophy, in the very few phrases he devotes to it, we find nothing more definite than vague allusions to "changes in the mental attitude," and "intimate friendly coöperation." Neither of these is a means, they are only ends to be attained.

If a public man must be judged by his writings, then there is some justification for the assertion that Mr. Taylor has failed to make out his case for the possession of any specific method of management that really stands out so clear and distinct from all other advanced modern methods, as to warrant the distinctive title of "scientific management." Nor, except in the sense that he personally is a gifted man, with a natural talent for administration, is it at all clear what feature of his system it is that demands "not advice, but CONTROL." Indeed such a claim seems to imply that "scientific management" as expounded by Mr. Taylor, like every other kind is simply a projection of the personal temperament and ideas of the manager. If it were really a science it would not need to be "personally conducted" in quite such an imperious and arbitrary manner; its facts, laws, and principles could be grasped by any technically educated and qualified man.

No one will wish to deny that modern advanced management owes a great debt to Mr. Taylor. He has fought a hard fight through many years in improving methods and in contributing to the perfection of "mechanisms." Thus for example his "time study," his "functional management" and his "differential rate" are three wholly separate and independent conbributions of value that he has made to our store of useful "mechanisms." But in regard to this claim for the development of a "science" or a philosophy of management, it is hard to avoid the conclusion either that Mr. Taylor is struggling unsuccessfully to explain himself, or that he has mistaken a statement of aspirations for a statement of how to realize those aspirations.

Manganese Steel for Machinery Parts

By C. A. Tupper

One of the notable tendencies in modern metallurgy, as applied to the manufacture of machinery, is the increasing use of manganese steel, which, from being numbered among the disappointments of a decade since, has gradually come to be adopted for a great variety of purposes formerly unthought of.

Among the more important of the earlier applications have been those in connection with rock and ore crushing plants, where manganese steel forms the lining and concaves of gyratory crushers, from the small sizes taking ore that will pass a 4-inch ring to the monsters that now crush a 42-inch block. Other types of machines for crushing work in various industries, as well as stationary and revolving screens, spouts, elevator buckets, etc., are similarly provided with parts or linings of this material.

Taking, at random, a number of other uses for widely different purposes, one finds that for the hardened centers of special track work, manganese steel has been for some years past extensively used and advertised; that the sheaves and blocks employed for logging purposes and other heavy work are faced with it; that it forms the lips and teeth of modern steam shovels and dredges and the chain links and buckets of trench excavators. Not many years ago it was stated in an address before the American Society of Mechanical Engineers that "the most important single use for manganese steel is for the pins which hold the buckets of elevator dredges; here abrasion is chiefly to be resisted." How far this condition has been altered, as a result of recent experience, may be seen from the above references.

These, however, merely illustrate tendencies that are becoming universal in the manufacture of machinery of the types designed for exceptionally heavy duty, where a hard steel is required that will resist surface wear.

If such wear is accompanied by an impact or blow, manganese steel is not so well adapted to the service, being too brittle; but, by the addition of some special alloy, such as vanadium, and corresponding modification of the manganese and carbon contents, so as to give greater toughness, its uses in this direction are also being extended. The material is one well worth the attention that has recently been given it and will repay further experimenting on the part of machinery builders having the problem of wear to solve. It should, of course, be remembered in this connection that, under ordinary conditions, manganese-steel forgings or castings cannot readily be machined and grinding is necessary for most purposes.

Would Calling for Wire by Decimal Size Be Practicable?

By W. Osborne

At various times some of the readers of the American Machinist have advanced the idea that it would be a good thing to discard all of the wire and sheet gages that go by numbers and use instead the micrometer. When I am reading such an article the reasoning seems to be so sound that I can see our gages going into the scrap pile after being pounded into such a shape that they cannot be used by someone who is still in darkness. I can see this, you understand, in my mind's eye, when I am sitting before the fire with my feet up on a chair, after having had a good supper, and when the room is filled with the spirit of common sense that comes from reading.

It is well not to be rash. Early the next morning, the office shows me a letter that asks us to explain more definitely what we mean by asking for No. 8 "English" gage wire. The gages are brought forth. One of them is marked "American or B. & S. Wire Gage." The other is marked "English Wire Gage." They are not private property, but belong to the company. We had ordered by the English gage because one of the slots in it came nearest to being the size of the wire than any of those which were in the American gage. The letter of the wire company stated that it did not have any knowledge of an English gage by that name but that the English generally used the Birmingham or Stubbs gage, or the Imperial wire gage.

One of the men had a private wire gage. It was marked "Stubbs Wire Gage," and it seemed to check up closely with our English gage. Hence, we concluded that it was safe to call ours "Stubbs" too. After some delay we got wire that did not exactly fit any gage on the premises but which possibly did fit one of the various specimens of gages in possession of the wire company.

How simple it would have been if I had sent in an order calling for wire 0.165 inch in diameter. At least it looked simple to me when I first thought of it, but when I got to studying one of the pages of the Brown & Sharpe catalog that chanced to be handy it did not appear to be so simple. That page shows sizes of six gages that are in use in the United States. The sizes run from 000000 to 40, or forty six in all. But if my checking is correct, it takes 234 *different* dimensions to correctly describe the widths of those slots, and more than half of them cannot be expressed in even thousandths.

When I send for wire I do it because I need the wire, and I generally want it quickly. In the present condition of things, I do not know what are considered stock sizes. Would this condition be worse or better if I ordered by diameter?

If wire could be had in certain even sizes beginning say at 0.500 inch and getting smaller at first by 0.020 inch down to 0.300 inch; then getting smaller by 0.010 inch down to 0.100 inch; from that to 0.050 inch, let the decrease be 0.005 inch; from 0.050 inch to 0.016 inch, let it be 0.002 inch; and from there down let it be 0.001 inch; there would be many of us who could make our work from these sizes and would be glad to do it if we knew that we could have our orders filled without delay.

With such a series beginning at 0.500 inch and ending at 0.003 inch there would be 70 sizes. It would not be a serious thing to have the differences only half as great as those I have given as that would give but three-fifths as many sizes as we now have. If, to this could be added a limit of variation above and below the nominal size it would appear like getting a start in a reasonable direction.

It is possible for me to believe that some wire may be required as fine as the ten thousandths seem to indicate in the given dimensions of the Washburn & Moen Manufacturing Company gage. I can imagine, when my imagination is in good working order, that some scientific man with a light-wave measuring machine at hand might be able to tell whether or not a certain piece of wire, measured at a certain place was the millionths of an inch required by the American, or Brown & Sharpe gage, but I draw the line when I look at No. 37 on the United States Standard for plates. When a size is given in billionths I begin to think that some joker has been getting busy.

I should like to know how a change to a decimal standard would suit the wire manufacturers and the large users.

Flywheel for High Speeds

The illustrations show a type of flywheel built by the Mesta Machine Company, Pittsburg, Penn., for high-speed motor-driven rolling mills. The wheel shown is 17 feet outside diameter by 24-inch face, and was built to travel at a rim speed of 10,000 feet per minute.

The rim is made of air-furnace iron with a tensile strength of 30,000 pounds per square inch, and as will be seen, the arm and rims of each half are cast together. These halves are then bolted together with a cast-steel hub in the center, the bore of the hub being 18½ inches and 36 inches long in this case.

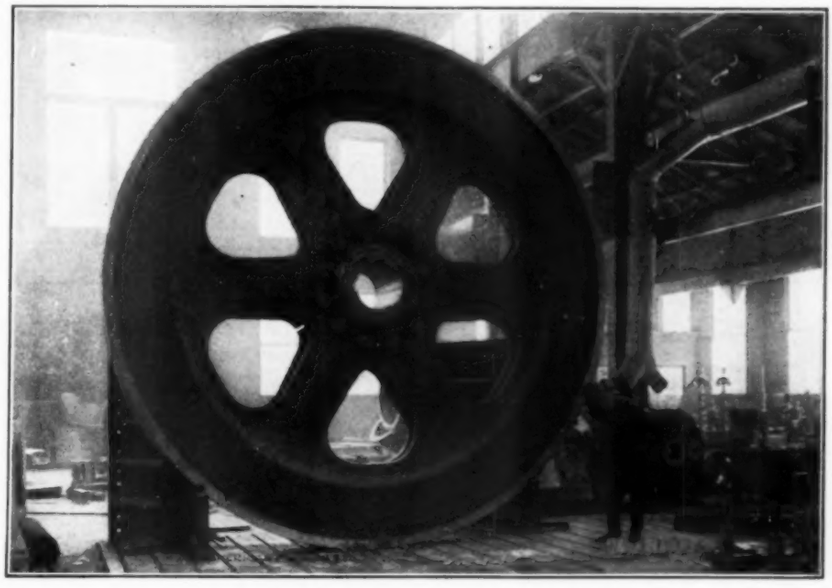


Fig. 1. High-speed Built-up Flywheel

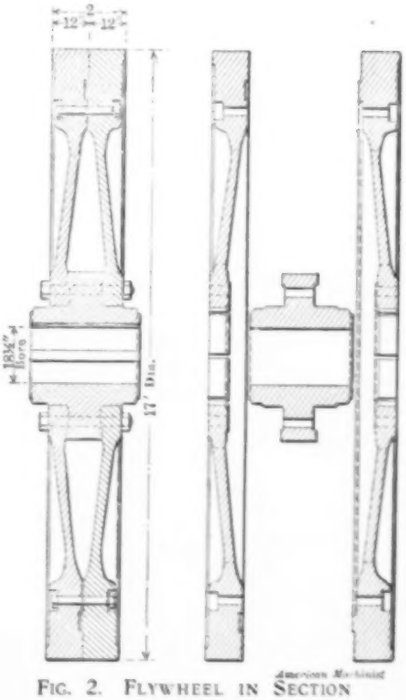


Fig. 2. Flywheel in Section

This makes an exceptionally strong construction, as can be seen both from the view of the entire wheel and the sectional view showing the details of its construction. The completed wheel weighs 132,000 pounds.

Making an Automobile Cylinder Pattern and Molding It

By C. T. Schaefer

The type of cylinder taken for example is the most prominent design that is extensively used in foreign countries. The pattern in question is for a double cylinder casting with its valves all on one side and with integral water jackets, for automobile and aëronautical engines. The casting must be made in a three-part flask, the pattern being parted on the lines *A A'* and *B B'*, as shown in Fig. 1. The size of the material is: Width *c* to *d*, length *e* to *f*, and thicknesses *k* to *l* and *l* to *m*. The timber runs lengthwise, that is, from *e* to *f*; the cleats run from *c* to *d*. Made this way, the pattern holds its size.

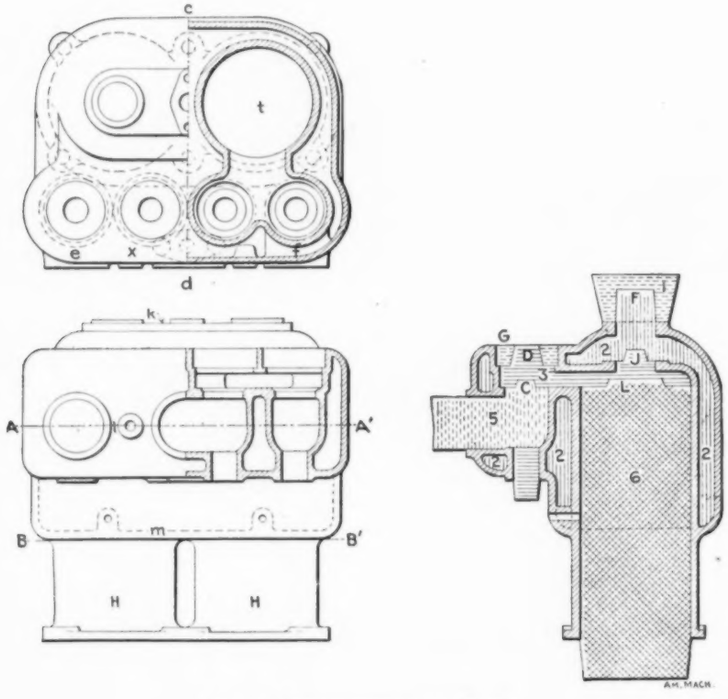


Fig. 1. Arrangement of Cores

Cleats, tongued and grooved on the ends, hold the flange at the bottom of the cylinder to size. The bottom parts of the cylinder *H* and *H* are turned up and set end-grain on the bottom flange. The rest of the pattern is worked out by hand, excepting the core prints and bosses.

The cross-section lines, Fig. 1, show the complete cone as it appears in the mold, on the lines *f* and *t*. Core 1, made in a separate box, is placed on the core prints *C C'*, Fig. 2, and rammed with the cope. This core is employed to make a clean closeup and to give a large bearing surface that will hold the cores when the mold is poured. The water-jacket core, No. 2, requires two core boxes; it is parted just below the compression chamber. Core 4 is part of core No. 3, but is made in a separate box. No. 3 is the combustion-chamber core. The exhaust- and intake-part core, No. 5, is jointed to the core No. 3 by a print. Core 6 is the main core of the cylinder.

Method of Setting the Cores

A special core plate is made that has thimbles on it to receive the prints *C* and *C'*, Fig. 2. The top half of core 2 is placed on the core plate with the prints marked *F* (Fig. 1), in the thimbles.

The part of the core that forms the compression chamber, exhaust and intake jacket has a flat spot in it at *x*, Fig. 1; it comes under the core print *D*, Fig. 2, and should be in line with *G*, Fig. 1. A boss on the plate fits this spot, just high enough to make the parting line of the core level. Core 4 is pasted on tenon *D* of core 3. Now, there is another boss on the plate, high enough so that the end *D* of core 3 can be placed on it and have that level also. Then the tenon *J* is pasted in core 2.

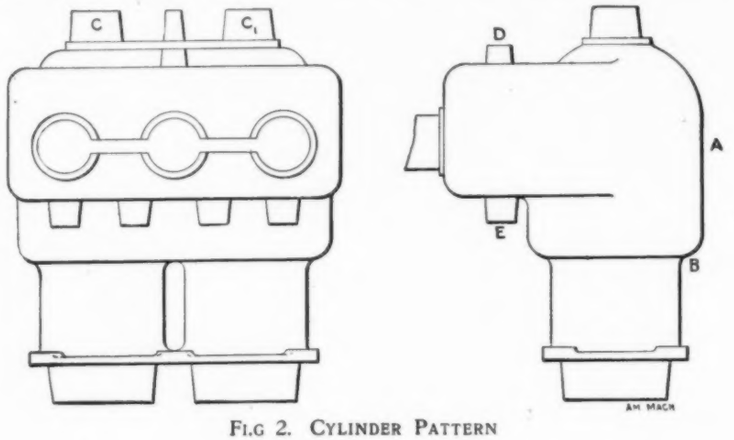


Fig. 2. Cylinder Pattern

After core 3 is in place, core 5 is placed with a pasted joint at *C*, and the outer end in a bracket that runs up from and is part of the plate, so placed as to locate the cores properly. The other half of the water-jacket core is placed and pasted. Then the whole put in the oven to dry the paste. It is essential to make a good job of pasting at *J*. After the paste has dried, a vent is made up through the points *L J F*, Fig. 1. The core is then ready to set.

Method of Molding

To mold, the cope is rammed, rolled over and rammed, checked and dragged, and lifted off the drag; the bottom of the pattern is drawn, the drag is placed back, and the whole is rolled over; the cope is lifted off and the pattern is drawn from the cope and checked. The body cores No. 6 are set first; then the cores shown at prints *E* and *D*, Fig. 2, are set. The cores pasted together are now picked up, turned over and set in the mold on the two-body cores, so that the tenons fit at *L*, Fig. 1, and the ends of core 5 fit the print holes in the sand. The cope is then closed and the casting poured.

Exports of iron and steel from the United States in the fiscal year just ended will probably be 235 million dollars in value, against 184 million in the former high record year, 1908. The total for the 10 months ending with April, the latest period for which details have been compiled by the Bureau of Statistics, Department of Commerce and Labor, is in round terms, 190 million dollars, and if the May and June exports approximate in each case those of April the total for the year will be fully 235 million dollars.

Securing Accuracy in Building Planers

Although the user of the planer is interested in securing the best kind of work and not in the way the planer was built, a brief description of the way they are tested while being assembled in the shop of the Cincinnati Planer Company will be interesting and instructive.

A special square, Fig. 1, is used for this work in order to secure extreme accuracy. This square has a special level, accurately graduated, so that each ⅛ inch graduation represents a variation of 0.001 inch in 4 feet.

The square is held against the housing and the position at which the bubble stops is noted. It is then placed against the opposite housing and the position again noted. Should they be different, the graduations show how much they are out and in just what direction the correction may be made. When they have been adjusted so that the limit of error is one graduation, or 0.001 inch in 4 feet, the holes in the housings are reamed and they are doweled into place on the bed.

After the bearings, shafts and gearing are put into place and tested before being permanently located on the bed, a fixture is placed across the bed as shown at *A*, Fig. 2. This fits into the V's and the edge shows when the housings are square with the V's.

The straight-edge is then placed on this fixture against the ledge on the fixture, and the facings of the housings tested for square with the bed. After this is done, the housings are tested for square on the side and face. This is shown in Figs. 3 and 4.

Substantial Seat for Punch Press Work

The illustration needs very little description. The two views show the front and back very clearly, and the construction of the seats can be easily seen.

These are used principally in connection with punch-press work, and allow the operator considerable side movement, as the seats are about 20 inches long. The back is narrow enough to be out of the way many times when a wider one would be inconvenient, and yet affords support in many positions that the operator may assume. These seats are substantially made from planed stock and are very liberally used by the Edison Storage Battery Company, West Orange, in their punch-press department.

SUBSTANTIAL SEAT FOR PUNCH-PRESS WORK

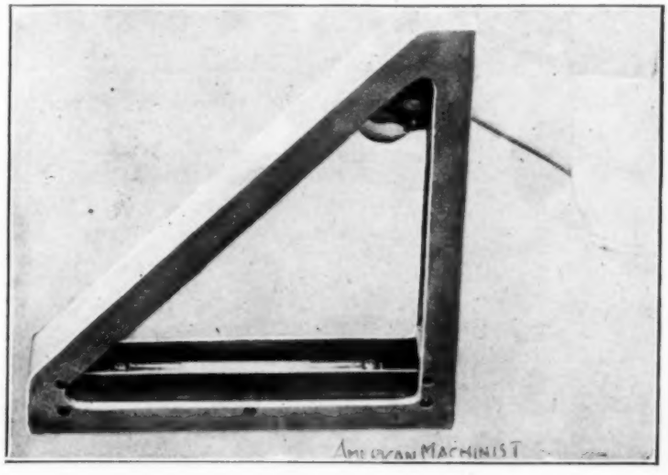


FIG. 1. SPECIAL SQUARE WITH ACCURATE LEVEL

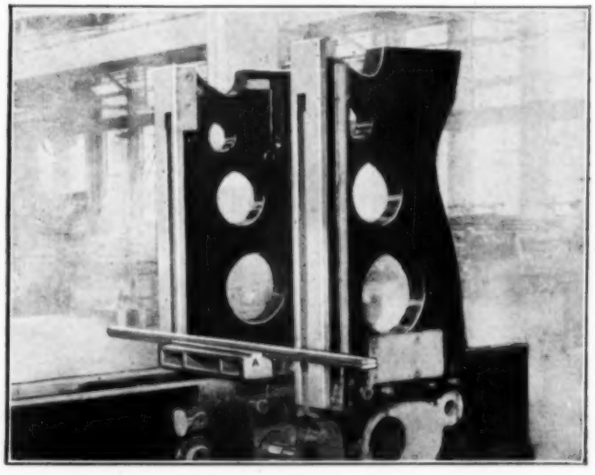


FIG. 2. TESTING FOR SQUARE OF HOUSINGS AND V'S

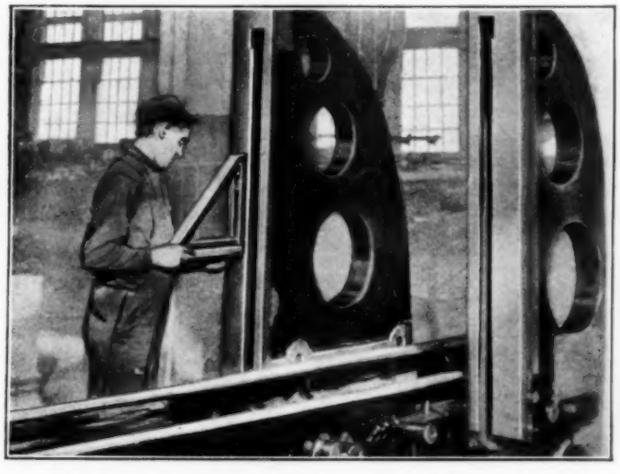


FIG. 3. TESTING HOUSING FACE FOR SQUARENESS

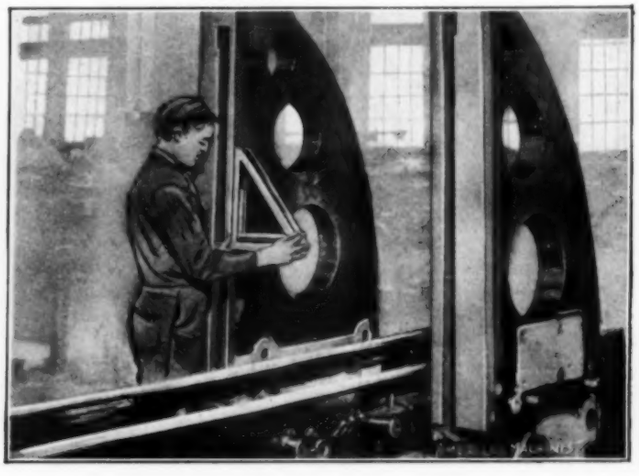


FIG. 4. TESTING HOUSING SIDE FOR SQUARENESS

Burnishing Bearings and Grinding Hardened Gears

The Locomobile Company, Bridgeport, Conn., has a rather unusual way of finishing the composition metal bearings in the large ends of their connecting rods, which is done by broaching and swaging, on a Lapointe broaching machine as shown in Fig. 1.

jig shown in Fig. 2, which consists of a heavy steel ring or box, into which the end of the connecting rod is set and the setscrews shown used to keep the bearing caps from being forced apart. This jig, of course, rests against the head of the broaching machine when in use, as shown in the first halftone.

Grinding Hardened Gears

This company has tried all sorts of devices for holding their gears for grinding after hardening with unsatisfactory results, and now the helical gears are clamped to a face plate as shown in Fig. 3, and four perfectly round and straight pins are placed equidistant on the periphery and held in place by rubber bands, and the gear is set true by using a test indicator. After the gear has been set so that the teeth run true, the gear is strapped down, the center clamp removed and the hole ground.

Bevel gears are trued in the same way; Fig. 4 showing the truing, with pins held on by rubber bands, and a clamp bolt and washer in the center, while Fig. 5 shows the gear ready to be ground, the test indicator being fastened to the machine by a bracket so as to be easily swung back while grinding and readily available for testing.

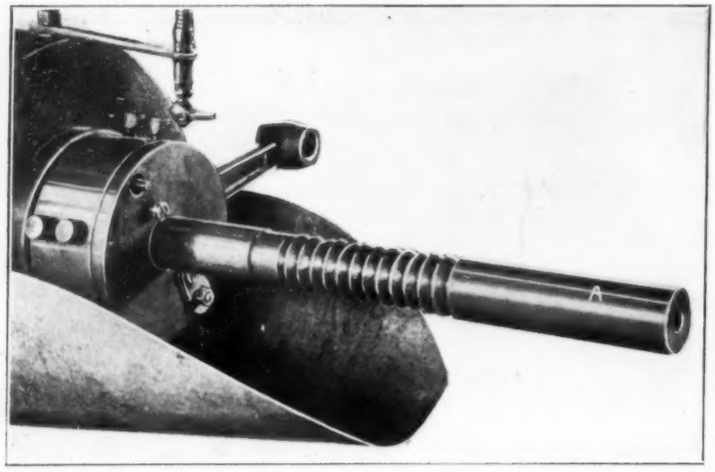


Fig. 1. Broach and Burnisher Used for Connecting-rod Bearings

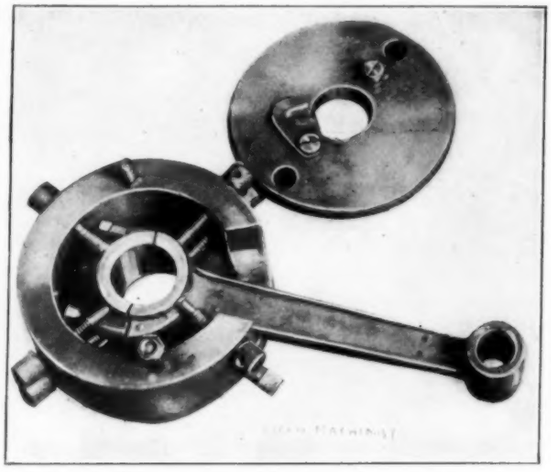


Fig. 2. Jig Used to Keep Bearings from Spreading

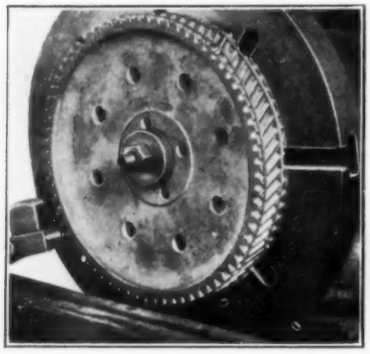


Fig. 3. Setting a Helical Gear

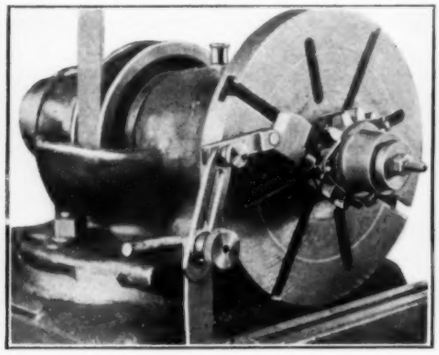


Fig. 4. Setting a Bevel Gear

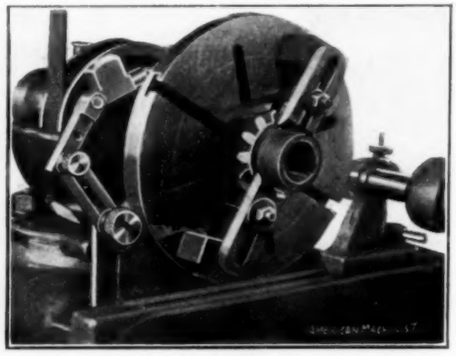


Fig. 5. Grinding a Bevel Gear

In the illustration, the broach is made to finish a 1⅞-inch hole and has 12 teeth which increase in size by 0.0005 inch each from first to last and the swage or burnisher *A* is 0.005 larger than the last tooth of the broach, being tapered slightly at the start, so that it doesn't shear the bearing. The bearings thus finished are very true and do not need to be touched with reamer or scraper. The lubricant used is prime lard oil and the engineer's figures show that it takes from five to six horsepower to run the machine and a pull of five or six thousand pounds to draw the broach through. The pressure of the burnishing part of the broach on the bearings is so great that some other means than the two regulation screws had to be devised to keep the parts from spreading, which is done by using the

Chart for Drill Speeds

The accompanying chart—or perhaps table—has been worked out with the cooperation of H. M. Norris, of the Cincinnati-Bickford Drill Company, and H. L. Seward, of the Sheffield Scientific School.

The data in regard to actual commercial speeds, used on commercial materials, with good lubrication and rigid machines for both carbon steel and high-speed steel drills, were furnished by Mr. Norris. These, with certain speed interpolations and exterpolations, to make the series complete within the range selected, were worked out in chart form by Professor Seward.

The arrangement is such that actual speeds are given for all drill sizes down to sixteenths within the range from ⅛ to 3 inches, inclusive. Specific speeds are not given for either the thirty-second- or sixty-fourth-inch sizes; but the operator sees that the speed for any sixty-fourth or thirty-second size is between narrow limits indicated on the chart. He can, therefore, select a suitable speed from those available on his drilling machine. This arrangement we believe to be preferable to an attempt to give a precise speed for each drill diameter.

Size of Drill	Drill Speed in R.P.M.			
	High Speed Steel Drill		Carbon Steel Drill	
	For Cast Iron	For Steel	For Cast Iron	For Steel
3/8	1019	1019	357	271
25/64				
13/32				
27/64				
7/16	873	873	306	226
29/64				
15/32				
31/64				
1/2	764	764	267	193
33/64				
17/32				
35/64				
9/16	679	679	238	170
37/64				
19/32				
39/64				
5/8	612	612	214	150
41/64				
21/32				
43/64				
11/16	556	556	195	135
45/64				
23/32				
47/64				
3/4	510	510	178	121
49/64				
25/32				
51/64				
13/16	471	471	165	110
53/64				
27/32				
55/64				
7/8	437	437	153	100
57/64				
29/32				
59/64				
15/16	408	408	143	92
61/64				
31/32				
63/64				
1	382	382	134	85
1 1/64				
1 1/32				
1 3/64				
1 1/16	359	359	126	79
1 5/64				
1 3/32				
1 7/64				
1 1/8	340	336	119	73
1 9/64				
1 5/32				
1 11/64				
1 3/16	322	317	113	69
1 13/64				
1 7/32				
1 15/64				
1 1/4	306	298	107	63
1 17/64				
1 9/32				
1 19/64				

Size of Drill	Drill Speed in R.P.M.			
	High Speed Steel Drill		Carbon Steel Drill	
	For Cast Iron	For Steel	For Cast Iron	For Steel
1 5/16	291	282	102	59
1 21/64				
1 11/32				
1 23/64				
1 3/8	278	267	97	56
1 25/64				
1 13/32				
1 27/64				
1 7/16	266	254	93	52
1 29/64				
1 15/32				
1 31/64				
1 1/2	255	241	88	49
1 17/32				
1 9/16	244	230	86	46
1 37/64				
1 5/8	235	220	82	43
1 21/32				
1 11/16	226	211	79	41
1 43/64				
1 3/4	218	202	76	39
1 45/64				
1 23/32	211	194	73	37
1 47/64				
1 7/8	204	187	71	35
1 49/64				
1 25/32	197	179	69	33
1 51/64				
2	191	172	67	31
2 1/32				
2 1/16	185	165	65	29
2 3/32				
2 1/8	180	159	63	28
2 5/32				
2 3/16	175	154	61	26
2 7/32				
2 1/4	170	149	59	25
2 9/32				
2 5/16	165	144	57	24
2 11/32				
2 3/8	161	139	56	23
2 13/32				
2 7/16	157	134	54	21
2 15/32				
2 1/2	153	130	53	20
2 17/32				
2 9/16	149	126	52	19
2 19/32				
2 5/8	145	122	51	18
2 21/32				
2 11/16	142	118	50	17
2 23/32				
2 3/4	139	115	49	16
2 25/32				
2 13/16	136	110	47	15
2 27/32				
2 7/8	133	107	46	14
2 29/32				
2 15/16	130	104	45	13
2 31/32				
3	127	102	44	13

American Machinist

Speeds of Drills

Jigs and Fixtures of an Auto Shop

By Ethan Viall *

An unusual form of cam-shaft keyway cutter.

A few cylinder operations and fixtures.

Gear-case drilling jig and a clutch tooth milling fixture.

Novel milling and drilling jigs made to compensate for irregularities of forgings or malleable castings.

*Associate editor.

One of the most interesting machines in the Maxwell-Briscoe Motor Company's factory at Newcastle, Ind., is a "fool-proof" machine for cutting keyways in inlet and exhaust cam shafts. With this machine it is practically impossible for the operator to cut keyways in the wrong position on the shaft, the only place where there is the slightest chance for a mistake being in setting the machine to cut inlet cam shafts and then machining exhaust shafts, or *vice versa,* but the chance for this is negligible, owing to the fact that the machine is looked over and set up by a first-class mechanic before the boy starts to cut the first keyway of the lot.

Figs. 1 and 2 show this machine in detail, the lettering being the same for both views. The cam-shaft gear is first keyed and locked on the shaft which is then run through the spindle of the index head as shown at *A* and is locked in by a contracting chuck or collet operated by the star wheel *B*. The shaft is kept from slipping in the spindle by the toothed block *C*, on the face of the index plate, which is also used as a guide in marking a certain gear tooth relative to the position of the cams, so that the shaft may be placed in the engine without unnecessary trying, by simply matching the mark on the gear rim with one on the crank-shaft gear. The handle *D* is fastened to the index plate to turn it while indexing.

The milling cutter *E* is run by the belt *F F* which is kept taut by the device *G* held down by the spring *H*. The cutter spindle is fed up or down by turning the handwheel *I*, which acts through bevel gears, on a sleeve nut, the elevating screw being stationary as shown. The depth of the keyway cut is regulated by the adjustable stop collars *J*, on the elevating screw.

As the second halftone shows, the indexing spindle which carries the cam shaft is connected by gears *K* and *L* to a second shaft *M*, running parallel with it. This shaft carries four collars *N N N N*, each with a hardened and lapped steel bushing in it, into which the stop pin *O* will fit when in correct alinement with it, but at no other time. These bushings are set in correct relation with holes in the index plates and the keyway positions on the shaft, so that when the plate *P* is indexed by drawing back the lock pin with the lever *R*, and turning it with the handle *D*, the bushing corresponding to the hole indexed in the plate, is brought around so that by moving the carriage one way or the other with the handwheel *S*, the stop pin *O* may be in-

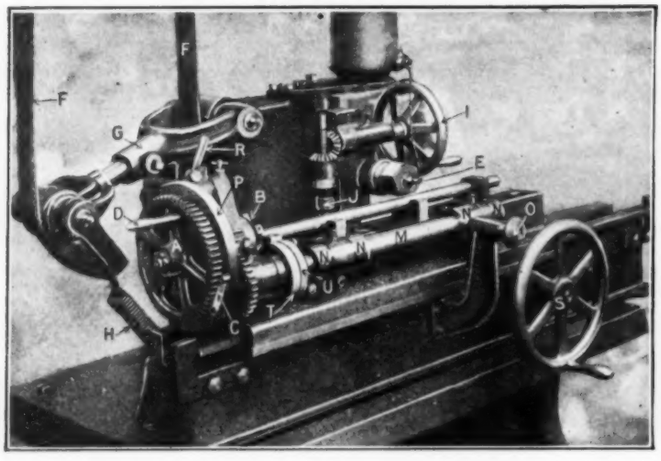


FIG. 1. CAM SHAFT WOODRUFF KEYWAY MILLER

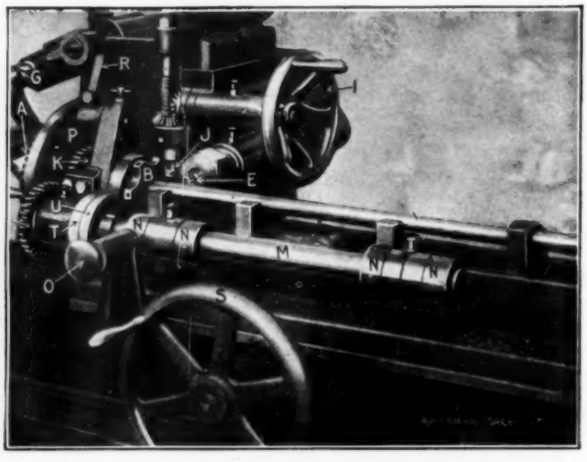


FIG. 2. DETAILS OF PART OF THE MECHANISM

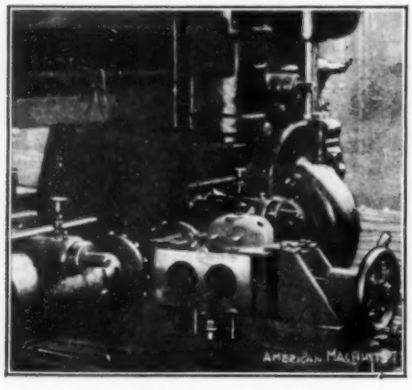
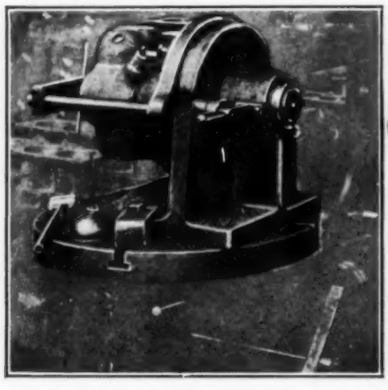


FIG. 3. CYLINDER-MILLING JIG



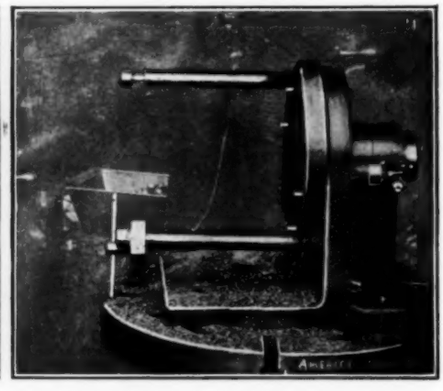


FIG. 4. INDEXING JIGS FOR HOLDING CYLINDERS WHILE DRILLING, REAMING OR TAPPING

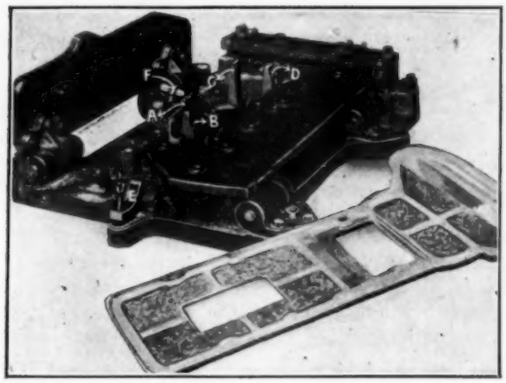


FIG. 6. DRILLING JIG FOR GEAR-CASE COVER

FIG. 7. DIFFERENTIAL CASE JIG

serted in the bushing in which it belongs and the cutter is fed down; the keyway finished; the stop pin withdrawn and the plate again indexed, which brings another bushing in line and *only one*. It will be seen from this that it is impossible to lock the carriage in anything but the correct position for the keyway to be milled.

Shaft *M* and its bushings, is set for the two kinds of shafts, inlet and exhaust, milled on the machine, by withdrawing a pin and setting the two collars at *T* and *U*, in relation to each other according to the mark stamped on them, and then replacing the locking pin.

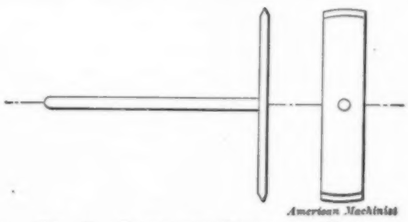


FIG. 5. GAGE FOR CYLINDER BORE

ORERATIONS ON CYLINDERS

The bottom flanges of cast-iron cylinders where they fit onto the crank cases are milled off in an Ingersoll miller as shown in Fig. 3. The top of the cylinder is also faced off with another cutter at the same time. The cylinders are held in the vise jig shown, which is a model of strength, ease of operation and simplicity.

Various drilling, reaming and tapping operations on the cylinders are done in the indexing jigs shown in Fig. 4, several forms of which are in use in the shop.

The type of gage used in gaging the bore of cylinders is shown in Fig. 5. This consists of a flat piece of steel into which a steel rod with center holes in the ends, is set. The ends of the crosspiece are turned, hardened and then ground to a V-section, as illustrated. As these gages wear they are easily peened longer with a hammer and the edges reground, which is an advantage over most solid gages.

DRILLING AND MILLING JIGS

A drilling jig for the holes in the crankcase cover is shown in Fig. 6. This jig is especially noticeable for the way in which the covers are hinged and the latches *A B C D*, used to hold the covers in place while drilling. The cover casting is held in position against stops by clamps *E* and *F*, and also by thumb screws in the covers and end piece.

Another jig used for holding the parts of the differential cases while boring and reaming the shaft hole is shown in Fig. 7. The half of the case is run over the spindle of the jig and locked with a split washer and nut. Any irregularity of the upper part of the casting is compensated for by two pins *A* and *B* operated by the forked clamp *C* which is brought down on the pin by turning the screw *D*.

Front spring-hanger forgings are milled on the side that goes next to the frame by placing them four at a time in the jig shown in Fig. 8 and machining with a side mill. The lower locating pins of the jig are stationary, but the upper ones are made so as to be easily withdrawn by means of the eccentric levers at the back.

MILLING FIXTURE FOR CLUTCH TEETH

Clutch teeth are milled bevel on the ends in the jig shown in Fig. 9. This jig consists of an ordinary three-jawed universal chuck which is mounted on a base and has a cam motion given it by two cam rings *A* and *B*, with four rises corresponding to the teeth of the clutch. The clutch is placed in the chuck under the milling cutter and the chuck rotated by hand by means of the capstan handles, shaping the several teeth on the clutch according to the shape of the cam rings, the chuck and clutch, of course, gradually rising and then dropping abruptly at the end of each cam rise, spaces between the clutch teeth doing away with any cutting difficulties that solid metal would cause.

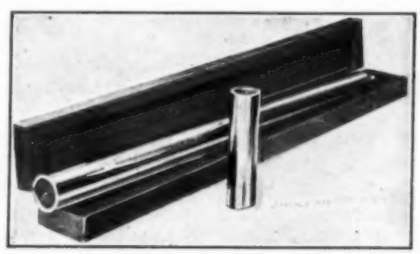


FIG. 12. ACCURATELY GROUND CYLINDER FOR LAYING OUT JIGS

COMPENSATING JIGS FOR FORGINGS AND MALLEABLE CASTINGS

Owing to the irregular shape of both forgings and malleable castings, espe-

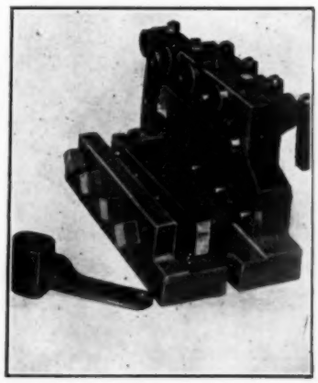


FIG. 8. FRONT SPRING-HANGER MILLING JIG

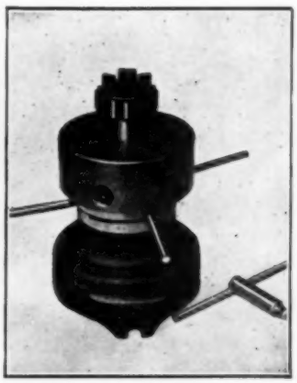


FIG. 9. CLUTCH-TOOTH MILLING JIG

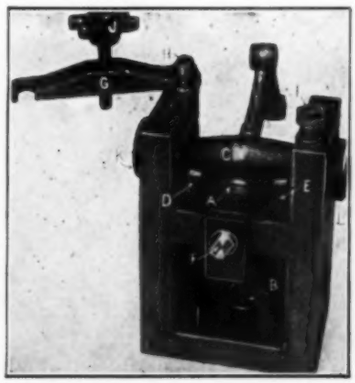


FIG. 10. COMPENSATING JIG FOR STEERING KNUCKLES

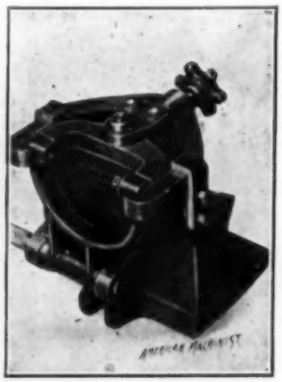


FIG. 11. COMPENSATING JIG FOR GEAR SHIFTER

cially the latter, it is often difficult to machine them properly, either by drilling or milling, as they have a tendency to give when clamped in a jig and then, when released after machining, springing out of line. For this reason some form of rocking or compensating device must be used in the jigs in which they are clamped, and an unusually good example of this class of compensating device is shown in the steering knuckle jig, Fig. 10. As the halftone shows, the finished axle piece fits into a hole in the center of the crosspiece of the jig at *A*, the end of it fitting into a hole in the base at *B*. The crosspiece *C* of the steering knuckle, rests in the V-shaped ends *D* and *E*, of the double fork, swinging on the pin *F* and a similar one opposite it on the other side of the jig. When the knuckle has been placed in the jig, the yoke *G* is swung into position, the screw *H* and *I* tightened and the clamping screw *J* run down onto the part *C*, which causes the double fork to tilt according to the irregularity of the crosspiece and automatically line it up with the two bushings *K* and *L*.

Another form of compensating jig is shown in Fig. 11, and when first made was designated the "ice tongs." This jig is made to hold a gear shifter while milling the inside surfaces of the fork ends which must be parallel with the outer surfaces and at right angles with the hole which have previously been milled and drilled. The fork and claw on the upper end of the jig are so made that they will adjust themselves to any spring or irregularity of the piece as the locking screw is tightened and afford a solid support for the fork ends, as the mill runs in, without distorting the parts in the least, as will be seen by a careful inspection of the halftone.

A Cylindrical "Square"

In laying out large jigs, it is very often difficult to use the ordinary type of square on a surface plate in such a way as to give the best results, and a very convenient and easily made tool is shown in Fig. 12. This consists simply of a cylinder ground on the end and ground parallel for its entire length, which is set on end on the surface plate with the jig, and the markings or plates of the jig, easily made plumb.

The long cylinder shown in the case, is made of a piece of tubing into the ends of which have been riveted short pieces of centered steel and the outside and ends carefully ground. This type of gage is more common across the water than in the United States, but for many forms of jig work is considered by some toolmakers as far superior to any of the ordinary squares with a heavy base which may be set on end but which are liable to be pulled out of plumb while in use.

Making Bevel Gears on a Plain Automatic

Editorial Correspondence

We are so accustomed to the use of multiple tools in automatic screw-machine turrets that we are very apt to overlook the cases where a perfectly plain machine can be used to advantage. This is clearly shown by the accompanying illustration, which shows some extremely interesting work being done on the plain single-tool spindle automatic machine of the Cleveland Automatic Machine Company, Cleveland, Ohio.

This machine is being used in the production of the small bevel-gear pinions shown, these being made from 2-inch bars, having a total length of 2 1/16 inches and the material weighing 1.6 pounds.

Details of Operation

The first operation is gaging the stock with the swinging stop *A*, which is then carried up out of the way, and the flat-forming tool *B* fed in from the front to rough the pinions down ready for the finishing tool. The hole is next drilled and chamfered by the drill *C* and the chamfering tool *D*, after which the circular forming tool *E*, which is ground all over to a shaved sample blank, takes the finishing cut. The cut-off tool *F* operates in an independent vertical slide, and the complete operation is done in 1½ minutes, or at the rate of 400 in 10 hours.

Simultaneous Operations

It should be noted that the rough forming, drilling and chamfering are simultaneous operations, and that by the use of the double cross slide, the time lost between the roughing and finishing is less than one second. By carefully timing the various movements from the time the bar reaches the stock stop to the cutting off, reduces the loss of time between the different operations so low that they can hardly be estimated.

This shows very plainly that there is a wide field for a plain automatic machine. The first cost, interest on the investment, upkeep and operation of any machine must all be carefully considered, and when this is done, we are likely to see a return to simpler machines in many cases.

The Swift College of Engineering, the new engineering school of the Northwestern University, Evanston, Ill., is a modern building on the shore of Lake Michigan. Two courses are offered, one leading to the degree of C. E. at the end of the fifth year, and the other in mechanical and electrical engineering, leading to the degree of E. E. at the end of the same period. During the first three years the courses are identical. Specialization in more advanced subjects is introduced during the fourth and fifth years of the course.

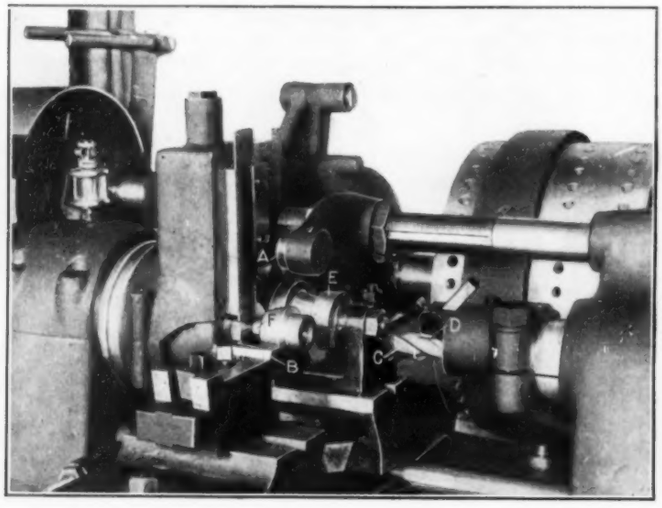


Fig. 1

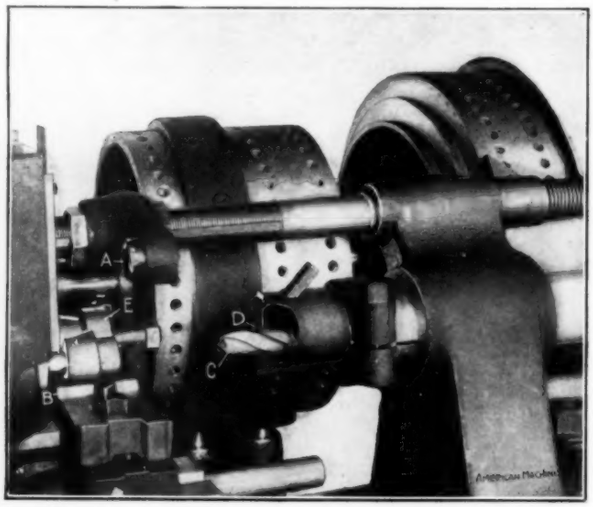


Fig. 2

Making Bevel Gears in a Plain Automatic Screw Machine

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

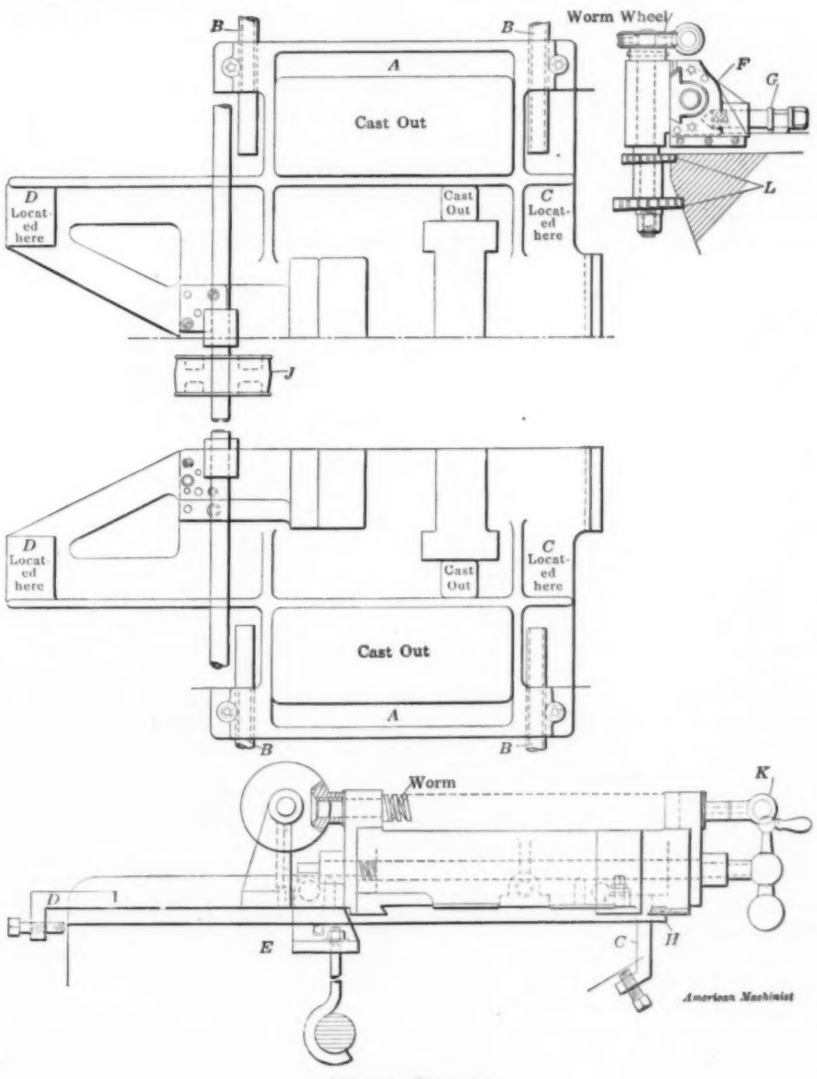
A Milling Fixture

In attaching a feeding mechanism to a cutter and creaser press, such as used in the ordinary printing office, it was necessary to finish two slots, one on each side of platen, as shown at *L*.

The first press platen was taken to the machine shop, holes drilled and the slots planed into them. This was an expensive method, so milling was suggested, and it was decided to build a milling fixture. The following description, with accompanying illustrations, show the fixture as used.

The presses vary from 20x30 inches to 23x31 inches, so the base *A A* is made into halves, joined by tubing *B B*; this allows for varying lengths of platen, and easy packing.

The base is located against the finished edge of the platen by two straps *C*, one shown, which also hold it down as shown; two straps *D*, one shown, are made long enough to be clamped in place for varying widths of platens; two straps *E*, one shown, hold down, by hook bolts, on the shaft of platen, and also have screws to take up end thrust and clamp the fixture.



MILLING FIXTURE

The carriage *F* dovetails into the base, and is located for in or out position by collar screw *G*, and held in position by gib *H*.

The driving-shaft pulley *J* belts up to the same pulley that drives the press, and through bevel gears, worm and worm wheel drives the cutter arbor. The bracket shown dotted at *K*, supports the shaft back of the bevel gear, and also keeps the gear in mesh. The gang of cutters is fed by hand, the cut being 3/16 inch deep by 9 inches in length.

When one side of the platen is milled the carriage is reversed to the outer end of base, the gib, handle and bevel gear changed to opposite end, the cutters reversed, and the belt crossed, also the driving shaft is taken out of its bearings to allow for changing the bevel gear to mesh in new position.

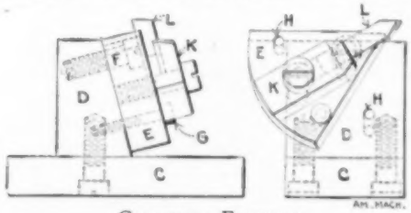
In conclusion, while we have nothing new embodied here, the fixture is light, portable, simple and it does the work. It may be stated that the milling of the four slots, including assembling the fixture upon the platen, is completed within 2½ hours.

F. A. WILKINSON.

Cliftondale, Mass.

Grinding Fixture for Thread Cutter

The cut shows a grinding fixture for grinding a thread cutter. Under the surface grinder *L* is the cutter in position to be ground. *C* and *D* are cast iron. The angle of *D* should be about 15 degrees.



GRINDING FIXTURE

K clamps *L* on *E*. *E* swivels on the screw *F* and is held in position by the locating pin *G*. To bring the other face of the V in position withdraw *G* and swing *E* so that the hole *H* in *E* is over the hole *H* in *D*. Then insert the pin *G*. To locate these holes clamp a center gage on *E* in place of *L*.

Jersey City, N. J. H. M. W.

Attachment for Planing Curved Dies

The illustration, Fig. 1, shows the front elevation of the planer. In Fig. 2, *G* is a face plate, clamped to the table. *E* and *F* are 1-inch square iron bars bent to the required curve of the dies and bolted to the table.

Fig. 1, *D, G, C* is an arm, which is bolted to the tool holder and has a roller at

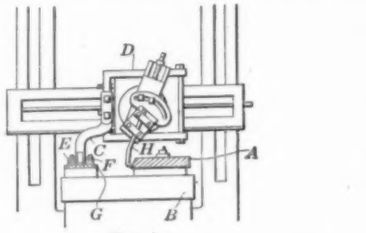


FIG. 1

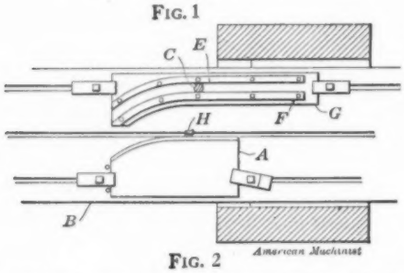


FIG. 2

ATTACHMENT FOR PLANING CURVED DIES

the bottom, fitting in the slot between *E* and *F*.

The feed screw is released, so that when the table travels back and forth, *C* will follow the curve and guide the planer head accordingly.

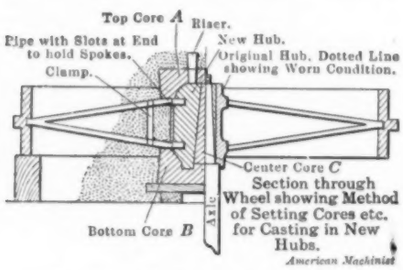
HERMAN BRODFRUHRER.

Louisville, Ky.

Casting Hub in an Old Wheel

Some time ago we had quite a rare job, having to cast new hubs in the two front wheels of a traction engine. As the old hubs were badly worn and cracked and too light to bush, the above was the only practical remedy.

The party was very much in need of


Top Core A
Riser.
Pipe with Slots at End to hold Spokes.
New Hub.
Original Hub. Dotted Line showing Worn Condition.
Clamp.
Center Core C
Section through Wheel showing Method of Setting Cores etc. for Casting in New Hubs.
Bottom Core B
Axle
American Machinist

CASTING HUB IN OLD WHEEL

the wheels, having put it off till the eleventh hour, as usually is the case, and didn't want to wait for new wheels from the factory.

The following describes the method used: We cut off a piece of 8-inch pipe, which was the proper size, and about 6 inches long, which was the outside distance of the spokes when separated to their normal position. This was slotted at the ends to allow the spokes to be held equi-distant. Then the old hub was broken out and the pipe clamped in place by clamps. Next we made core boxes for cores *a, b* and *c*; *a* and *b* were made from the same box, by making two different center pieces to form the ends of the hub. This will be easily seen by referring to the line cut.

The cores were then made and dried, and the wheel blocked up with the bottom core on a board, to prevent breaking under the center. After the wheel was leveled, the core *b* was wedged in place against the pipe and sand rammed under the board and around the center of the wheel.

The top and center cores were then placed, two openings being made in the top core, one for the gate and the other for a riser. To insure getting a sound casting it is best to feed or churn it a little, as some people term it.

A. W. WINTERBORNE.

San Antonio, Tex.

A Drilling Jig

The illustration shows a machine detail in which are drilled four 5/16-inch diameter holes. The shape of the piece and the location of the holes make the job a very difficult one if performed in

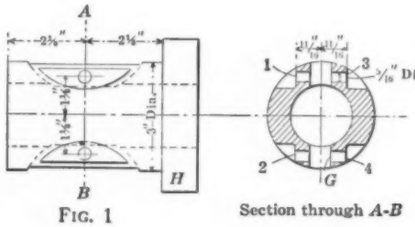


FIG. 1 Section through *A-B*

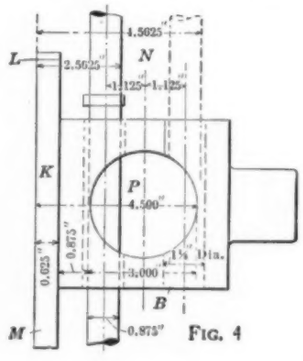


FIG. 4

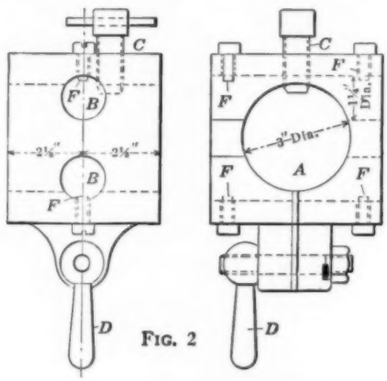


FIG. 2

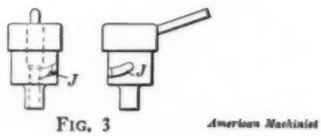


FIG. 3

A DRILLING JIG

then drilling to the marks, and after experiencing the difficulties mentioned we came to the conclusion that the only satisfactory method of doing the work was by the help of a jig.

The jig we evolved is shown in Fig. 2. The work is slid into the jig and located (1) by the taper end of the screw *C* entering the slot *G* and (2) by the collar *H* on the work being pushed against one end of the jig. The jig is then clamped by the lock handle *D*. The bush which guides and locates the drill is shown at Fig. 3; it is of hardened tool steel and is provided with a helical groove which engages with the ends of screws *F*, in jig, in order to obviate all danger of the bush being pushed out of the hole by the action of the chips. A small handle is fitted to the bush so that it can be more easily moved from hole to hole. The method of using the jig is, as follows: The work is first inserted and clamped, the hardened bushing is then placed in one of the holes *B* and one of the holes drilled. The bushing is then moved to the other hole and the drill is again applied. When both holes on one side (say 1 and 2) have been drilled, the bush is withdrawn, the jig turned over and the remaining holes (3 and 4) drilled in a similar way.

Fig. 4 shows how we machined the jig, or at least the most important parts thereof. The 3-inch diameter hole was first accurately bored and reamed to size; the jig was then driven onto an arbor and the ends carefully faced so that they would be square with the axis of the hole and also so that the length of the hole would be 4¼ inches as specified.

All the remaining sides (with the exception of that where the locking handle is) were then milled, care being taken to insure squareness in each direction. A cast-iron plug was then made to fit the 3-inch diameter hole so that the boring tool would be working in solid metal all the time and not marring the accuracy of the job by breaking out into the large hole.

After the miller had been tested as to the accuracy of its various slides, the

jig was clamped to the table, the side *K* being set parallel with the cross-feed by the aid of an indicator. A small independent chuck was next mounted on the spindle nose and the 7/8-inch diameter boring bar clamped therein dead true. The other end of the boring bar was supported by the outer support just like an ordinary cutter arbor would be, only in this case as a precaution, the outer support had to be adjusted so that the boring bar was parallel with the face *K* of the jig. A small straight-edge was then lightly clamped against the face *K* and the distance from the outer edge of the straight-edge to the center of the 3-inch hole found by measuring at *P* with a micrometer. This being determined a little bit of addition and subtraction gave us the dimension *L*, after which it was a comparatively easy matter to adjust the table of the miller until the micrometer applied at *L* showed it to be correctly located.

I forgot to mention, though, of course, it is perfectly obvious, that two 1⅛-inch diameter holes have been drilled in the jig as near to their correct position as careful marking out and drilling can make them.

After the measurements have been verified, the cutter properly set and all slides clamped, the hole is bored, using the automatic cross-feed.

Birmingham, England. M. MILLER.

Shop and School Education of Boys

Whether or not manufacturers are wholly to blame for the present shortage of capable mechanics, whether it would help matters if they should rehabilitate the apprentice system, and whether any of the half-way systems of trade education that have been proposed are good, are all open questions. Of late the school men have rather monopolized the floor. Professor Kimball, especially, at page 781, has raised these questions among others. As a former employer of machinists, I wish to say something in defense of the position in which my active brothers find themselves.

In the first instance, I do not believe that we are to blame for the present absence of the apprentice system, nor do I believe that the effort which is being made by some large shops to revive the system is likely to be feasible for small shops. I certainly think and hope that the day of the small shop is not past.

My own experience has been that apprenticeship decayed for lack of apprentices. Boys simply did not want to learn a trade. All these shop schools, when stripped to the bare facts, are simply different forms of bait to attract boys. A boy will go to a school and work for nothing, where he will not go into a shop at a dollar a day.

The school may be in a shop, and the shop may be in a school; either way, it is the school which draws the boys. Do not think for a moment that I am decrying the school. All that I wish to show is that the apprenticeship system, without a school, has gone, through no fault of the employer, but simply because it no longer attracts boys. Why this is so is for some psychologist to answer. I only know what I have observed.

In the second instance: I do not think that small or medium-sized shops can afford to start their own schools. It is entirely outside of their legitimate field, and the natural "wanderlust" which is in even the best of our boys, leads them to desert the parent shops in such numbers as to make such a school more or less of a charitable institution. It is all very well to say that the parent shops ought to pay their graduates money enough to keep them, but as a matter of fact, after being tied up for three or four years, there simply is not money enough to keep them, once they get the travel bug in their heads. In the third instance, we find the larger question, what does a manufacturer want in the way of trained help? Stripped of all the flowers of speech, what a manufacturer wants is the largest amount of service for a dollar that he can get. The kind of service that he will pay the most for today happens to be thoroughly skilled workmen and foremen. He does not care for men who will at best only work for a year or two at the lathe, planer or bench, nor does he want foremen who will only stay as foremen a few months to get sufficient experience on which to go higher.

Below these grades he has places for all the young men whose fingers and brains are educated to even the slightest degree. He wants intelligent laborers. I remember a case in point. When we were paying $7.50 per week for helpers, a man came along and wanted a job helping, but he wanted $11. We were paying some pretty fair machinists only $10.50, but he was willing to step out at the end of a week if I was not satisfied. I forget just how many years he stayed, it was over five at any rate. Then I lost him because one of my competitors was willing to give him $13, and I very foolishly refused to do as much. That man had no ambition to be anything more than a helper, but he did want to be a helping kind of a helper, and he was. He could clean castings in half the regular time. He could paint and fill, and he learned our work in a few weeks, so that he could pick out castings that were wanted and keep them piled up ahead of the men; he could handle heavy work, take up belts, in fact, do anything that would leave our machinist free to do machine work.

We need just such men and we need a lot of them. We do not care whether they are graduates of any school or not. We do not care whether they know a fundamental from a countershaft, so long as they deliver the goods. We know that it takes experience to make such a man, but we do not care whether he gets that experience in school or in a shop. We suspect that if he is taught in school he will not get experience, because we realize that our own experience comes from making mistakes, and doing things "on our own hook," and finding out whether they work or not. We fear that the schools mollycoddle the boys, and neither let them make mistakes enough nor show them the consequence of their mistakes with sufficient force. We realize that experience is expensive, that shops fire men who make mistakes, but that other shops hire them, and that they are worth more every time they make mistakes. Cannot the school imitate these actual conditions instead of trying to make everything fool proof? Are not the schools trying to do too much for the boys?

Then when we get to other branches of the trade above laborers, there is room in the shops for every grade. Only we do not want to be led to expect too much of a boy because he has been in a school or a particular shop. We do not care a rap about a diploma. What we want is results, and we can pretty generally tell whether we are getting them before pay day.

We have certain fundamentals, such as punctuality, steadiness, attention, celerity, etc., which apply to all grades of men. If we can get men that meet our needs along these fundamentals, we will find places for them at wages proportionate to their ability, but we are not looking solely for expert diesinkers, nor for all-around machinists. We want all kinds. This is the manufacturer's viewpoint.

From the viewpoint of the boy and of the community in general, these boys ought to be trained to fill as high positions as it is possible for them to fill, with especial care that they are not overtrained or trained for positions higher than their ability will enable them to keep, for if there is one duty that educators owe to society, it is not to make second-class men think that they are qualified for first-class jobs.

I want to enter a mild exception to Professor Kimball's statement on page 784: "Skill in the use of hammer, plane and saw, precedes their application, to the carpenter, patternmaker or cabinetmaker's trade." This has been assumed so long that it is getting into the same class as the saying that: "We must creep before we walk," which is entirely untrue in a large number of cases. In fact, out of my four children, only one ever crept before learning to walk.

The use of saw, plane and hammer, as well as of file, cold chisel and lathe tool, can be best taught as a part of the trades in which they are used, and as real work distinct from exercises. There is nothing that disgusts an employer more than to find that a boy has frittered away his time making things of no earthly value, for the sake of learning how to manipulate tools.

One more point: Cannot these schools, all the types which Professor Randall expects to see and all the others, allow their graduates to get jobs on their own merits. I heard the other day of a girls' school somewhere that does not give a diploma until after the girl has left school, gotten a position and held it a certain length of time, and is earning a certain amount.

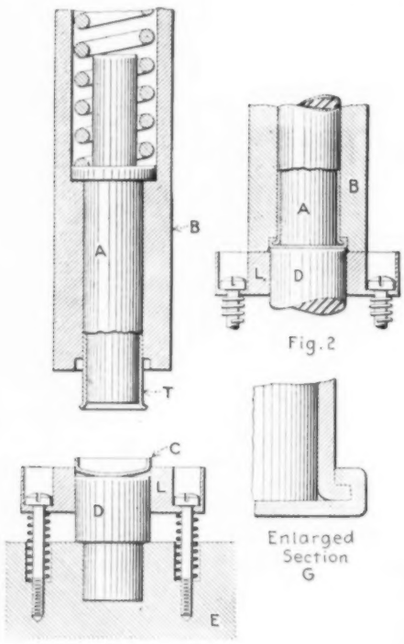
If the boys' schools will do this, they will find one of their difficulties easily avoided, and their pupils will be all the better for it.

EX-MANUFACTURER.

Worcester, Mass.

A Seaming Die

Fig. 2 shows a brass tube, 1 inch diameter, 0.042 inch thick; one end is flared out 0.042 inch and a cap 0.042 inch thick seamed over it. The bends of the metal



A SEAMING DIE

are very short in proportion to the thickness. The ends of the tube must be flat. The tube was flared in a clamp die and the cap drawn up in the usual manner.

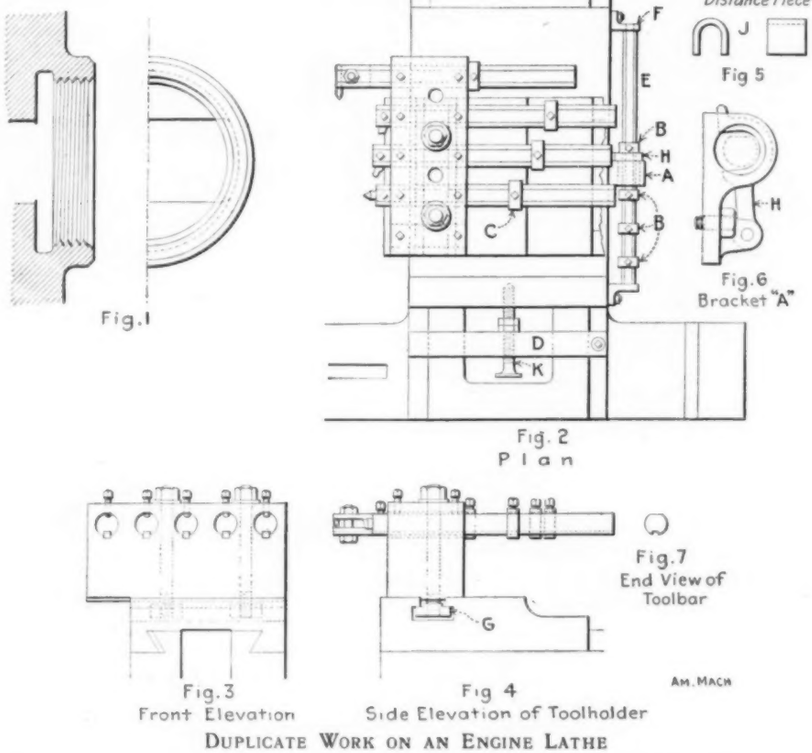
Fig. 1 shows the punch and die with the tube and cap in position. *T* is the tube and *C* the cap. The cap rests on the die *D* and is located in position by *L*, which is held up by springs. The tube is placed between the pressure pad *A* and the punch *B*.

The die works as follows: As the punch descends the tube enters the cap, causing the pressure pad to flatten the cap and finish turning the flare on the tube to a right angle. When the punch reaches *L* it pushes it down out of the way, allowing the die *D* to force the cap up into the punch *B*, which seams the cap around the tube. When the punch goes up, the spring pushes the pad and work out of the punch.

Springfield, Mass. C. H. WILCOX.

Duplicate Work on an Engine Lathe

Having a large number of castings to machine, as at Fig. 1, in which time and accuracy were great factors, the single tool post was substituted by the multiple tool holder, of which general plan view is given at Fig. 2.



DUPLICATE WORK ON AN ENGINE LATHE

This tool holder was fitted to a standard 12-inch Flather lathe, blocked up to 14 inches to swing the castings, and the facing rest was furnished with separate stops for each tool.

The tool bars were made of 1¼-inch cold-rolled stock, with keyway ¼ inch wide on the under side to prevent turning a flat ½ inch wide on top and fitted with a sliding stop collar *C*.

The stop bar *E* was made of ¾-inch cold-rolled stock, threaded 18 to the inch the full length.

The stop bracket *A* was bolted to one of the back stay holes and pinned on the lower side of the carriage.

The bridge stop *D* was used only to set the cut, while using the thread tool.

The mode of using was as follows: After truing the casting on the faceplate the boring tool was pushed out up to the collar, the stop latch *H* thrown back and the facing rest moved to piston, the stop bar *E* moving through *A* at the same time. The latch *H* was then returned to position and the rest brought up against it, this giving the correct size for boring.

After the boring tool was pushed back and the latch *H* thrown out, the next tool was brought into position for facing the bottom of the hole. This completed, the tool was pushed back far enough to allow the distance piece *J* to be interposed between the holder and the collar, this giving the correct distance from the bottom of the hole to the face.

For threading, the latch was again opened and the thread tool brought to position, as shown in Fig. 2.

On completion of this operation the tool was placed for chamfering the inside, using the last stop. The outside of the hole being machined to remove sharp edge, no stop was necessary.

This tool holder is capable of numerous combinations and being cheap of construction and easy of adjustment, can be fitted to any engine lathe having a compound slide rest, thereby making an efficient substitute for a turret machine for chuck and faceplate work.

Beverly, Mass. ALEXIS.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

The Science of Inventing

On page 847, Volume 34, the question is propounded editorially "Can we have a Science of Inventing?" and the writer appears to be of the opinion, that if such a condition could be achieved the stigma alleged to be attached to such genius as is displayed by an inventor would be removed.

This species of holding him up as a man of sorrow (for such the inventor usually is) brings lucidly to my mind the time, a quarter of a century ago, when by the great majority the inventor was considered a long-haired crank and permitted, by the community, the indulgence of traveling abroad from much the same spirit of charity accorded the trustees of the insane asylums of today.

That inventing is and always has been one of the most exact sciences, and something more, it is thought will be admitted by anyone who has tried it for any length of time. It is usually in a field of much value, where there is little or no literature to throw light one day ahead so that the inventor may know for a certainty how his experiments will turn out. Of course, the deadwood of the past is of some value in showing what has been done by others in lines nearly parallel, but it is not and never can be a light that will illumine the future. The time will never come when inventors can be turned out by the schools like doctors, lawyers, or mechanical engineers; if that were possible then invention could be and would be a prosaic science.

Mechanical engineers may be talented designers, yet possessed of little or none of the genius necessary in the man who has the insight, and intellectual capacity to go even one month ahead of all the educated men in the world, dig out a simple idea, hold it up to the firing line and truthfully say—this is something no man has seen before since the beginning of time.

Such, however, has been done by every man who has produced anything of great value in elevating the human race above the rest of the animal kingdom. The schools are powerless to produce such men—they must be born with this ability.

Inventors Are Geniuses

The great musicians like Mendelssohn, Verdi, Beethoven, and artists like our own Whistler and Benjamin West are acclaimed geniuses with such fervor that it would not enter the ordinary mind to dispute the fact. These men brought within the power of mankind to derive pleasure from sights and sounds essentially new. As such they have added much to our happiness. The certainty that they accomplished these things while they endured more or less harsh treatment and humiliation at the hands of their contemporaries may be one reason why succeeding generations try to glorify them as ing any adequate conception of the mengeniuses, without one in a thousand havtal processes which enabled them to do what they did. On the other hand the inventors who have come into the world evidently for a purpose as specific as any of their brothers in the sciences of music and art, according to what we would be taught, are laboring under a stigma which can be removed by their work being brought down to the level of a prosaic science.

The lives of practically all the great inventors show us that they have suffered from the intolerance, bigotry and jealousy of their fellow-men. The inventor of the first umbrella was mobbed in the streets of London, yet among all the users of this article how many can be found who know the name of this man or if they did would give a thought to his sufferings?

Faraday, Watt, Murdock (the inventor of illuminating gas), Morse and others endured the galling intolerance of their times. Yet by what they did and by their example they have done more for the uplift of mankind from the slough of darkness than the great musicians and artists. The same spirit if not a more exalted one is animating the inventors of the present day.

The heavily endowed schools of research are extensively using their resources on bugs and butterflies, while the plain American inventor is achieving the tremendous epoch-making results along nearly all useful lines. The first class represents what prosaic science can do, while the second represents in the main the work of genius.

This country has much material out of which to make the men who are placing this country above all the nations of the earth industrially; they thrive under our liberties. Yet we sadly lack an adequate appreciation of their work, although to anyone who has intelligently watched the trend of public thought in this field it is evident that we are advancing much faster than any other country in the world.

We do not need, nor could we use a prosaic basis of science to work from; but just laws that will not often require expensive litigation with infringers for practically all the 17 years of the life of the patent.

When this condition and a few others of kindred character are removed many able men who hold up their hands in horror at the name of invention now, will delve in the dark regions between the known and the unknown with as great industry as that shining example of American genius, Thomas A. Edison, whose only early education was received at his mother's knee.

Newark, N. J. George J. Murdock.

Apprenticeship System Makes Progress in France

On page 542, Volume 34, you published an article by C. R. Dooley relating to the solving of the skilled mechanic problem.

Now, we in France look upon America as a country far ahead of all others in all matters, and it is interesting for us to know we are marching with the times. But we are handicapped in our training systems to a large extent by national conscription, which forces all young fellows 21 years old into the service of the country for two years. Therefore, a young chap leaving school, say, when he is 14 years old, has seven years in which to learn his trade thoroughly, for, after a fellow is 23, he must begin to earn money.

In my firm, Clement Bayard, automobile constructors, we have commenced a system of training young apprentices, and it has worked remarkably well for a year; so well, in fact, that we are expanding the training shops and class rooms. A shop has been installed with modern machinery, and the lads are instructed in the workings of the machines by a general foreman and two men in charge. There are lathes, millers, grinders, planers, and, of course, filing benches.

The apprentices work under a bonus system. The lads earn 25 centimes (5c.) per hour, and are able to supplement their earnings by bonuses. They do the everyday shop jobs, but, of course, are not pushed for the work; hence, they can make good jobs. Also, a class room has been installed with desks, boards and

books, for lessons in machine and automobile design and English language. Four hours a week are devoted to these two subjects, two hours to general design and two hours for English. They are instructed in design by one of the head designers, and in English by an Englishman.

The lads are making such progress that the management has decided to devote two hours a week to encouraging sport. A football field has been equipped with all the necessities, and the Englishman instructs the lads in the mysteries of English association football.

We have now about one hundred apprentice boys, and in the near future hope to enlarge; for this branch, besides being good for instruction, is also a source of considerable profit to the firm, as the boys are industrious and work exceedingly well.

In fact, an apprenticeship at Clement Bayard's is a thing much sought after by young French boys who wish to become skilled mechanics.

Seine, France. H. WOOLLEN.

Expanding Mandrel for Solid Side Rod Brasses

I note with interest an article under the above title by C. M., of Clinton, Iowa, on page 652, Volume 34. The tool appears to be a very unique and efficient one for the purpose, but the reading of this article recalled some experiences of mine in turning bushings of this type, something more than 20 years ago, when tools for the efficient handling of railroad work were rather scarce, and in a great many cases a man had to rely on his wits to get out the work required, rapidly, and of good quality.

The lathe I used at the time was equipped with a four-jawed universal chuck, with non-reversing jaws, and the bushings without the collars, were caught in the four jaws as near the edge of the castings as would give a secure grip for holding the work solid enough to take cuts of sufficient depth and feed to get the work out in good time. If the bushings were somewhat elliptical it was necessary to revolve them in the chuck jaws, feeling them around until the four jaws would find approximately an even bearing so the casting would not be sprung in tightening up.

The first cut was taken across the outer edge of the bushings, facing it off, then without changing the position of the tool, a roughing cut was taken over the outer side of the bushing, turning close to the chuck jaws, leaving just enough for a light finishing cut to be taken after the bushing was bored out. Then the tool was changed for a boring tool, and the bushing was bored out to the proper finished size, allowance being made for the shrinkage due to the forcing of the bushing into the rod, so that when finished and in place in the rod the bushing was expected to be a proper working fit on the crank pin without reboring or scraping. The last cut taken at this chucking of the piece was on the outside, making the proper fit in the rod, and as close to the chuck jaws as possible, sometimes in extreme cases it being necessary to re-set the tool, and turn somewhat under the chuck jaws.

The piece was then taken out of the chuck and turned around. In re-chucking the bushings the face side was held against the face of the chuck, this with the universal chuck, being the means of re-setting it practically true. The rough end was then faced off, giving the proper length of the bushing, and the small collar left from the previous chucking was turned off to the size of the previous turning, and then slightly tapered with a hand scraper, making the extreme end for a short distance somewhat smaller than the fit in the rod, this allowing for the starting of the bushing in the rod, when setting up in the press. The bushings when turned in this way had a tendency, depending on the composition of the metal used in the casting, and the amount of power used on the chuck wrench in tightening up, to come out of the lathe somewhat four sided, but as the turning and boring were true with each other we found this foursidedness disappeared when the bushings were forced into the rods.

Saginaw, Mich. A. B. COLE.

Shop and Office Lighting

The number of articles appearing relating to shop and office lighting, shows the interest which is at last being taken in this important subject. It will be well, however, for those interested not to base their conclusions solely upon published reports and photographs showing what has been accomplished, since both may be misleading. The quality of the light is of as much or more importance as its intensity and general diffusion. A good light is one suited to its purpose and falling at the proper angle upon the work to be done, and for many purposes, drafting particularly, the light which comes from directly overhead is not the best, and this applies with especial force to artificial lights as the best of them do not possess the desirable qualities of daylight.

It is readily understood that we may have a condition in which the supply of light is about all that could be asked and yet of a quality which would assist very little in the production of blueprints; but it is less fully appreciated that light satisfactory to a bookkeeper may prove trying to a draftsman, and entirely insufficient for making tracings.

Possibly the efficiency and other desirable qualities of the mercury vapor lamps are, in some cases, more than offset by the depressing effect which this light has upon many persons. Just what the cause of this influence may be is difficult to say. Perhaps it is only on account of the peculiar appearance which they give to all objects, particularly the human countenance. If this is the case the impression is upon the mind only, and it may be said that men should not allow it to affect them; however, the fact remains that it produces a condition which must be met as fully as though the cause were a more tangible one. That men are unpleasantly influenced by seeing their fellow mortals look like a lot of recently exhumed corpses may be convenient but it cannot be helped. A point also which should not be lost sight of is that a photograph of a shop lighted by this means is a poor criterion by which to judge of the efficiency of the illumination for any purpose other than that of taking the photograph. The mercury vapor light, like that of magnesium, renders photography possible with a degree of illumination entirely inadequate for other purposes. With a rosy or a yellow light, such as that from ordinary incandescent lamps, the effect might be much better for nearly every purpose and yet make the taking of a photograph a practical impossibility. JOHN J. LITTLEJOHN.

Pittsburg, Penn.

A Plea for Straight Piecework

I fully agree with Mr. Jacobsen's recent articles in the AMERICAN MACHINIST (pages 631 and 932, Volume 34) and his preference for straight piece work. To me it has always seemed more business-like to go to a man with a proposition to do a certain amount of work for a certain amount of money.

The premium system is used in many shops where the men object to piece work because it is contrary to the rules of their labor organization; it is, therefore, a straddle or compromise. If a very careful study is made of the time required for each operation on a job by a high-grade man, the premium plan can be made to work fairly well, but the whole scheme is a makeshift as compared with piece work followed up by a rigid inspection system.

I have always found it a good plan to put long distasteful jobs on piece work. For example, we had an immense quantity of small hexagon nuts to castellate; first one boy was put on the job, and then another, but in a few days they would tire and go fishing, as it was no snap job and called for work every minute. We had a college boy working with us during his vacation, who, to ouh surprise, asked for the job on the condition that he could have permission to make all it was possible to earn; this was readily granted. The boys who preferred to go

fishing had earned about $1.30 per day at this work, but our college boy worked like a football hero until it was finished and earned about $3.75 per day.

Mr. Jacobsen refers to the human nature part of piece work, which recalls my experience with a certain mill and drill hand of great honesty, small day rate, and large family. Occasionally he would have a price that was too high; after working a while, he would say,

"Mr. ———, I can no kill time on this job."

Then an adjustment would be made. On the other hand, if a price was very low, it would be,

"Mr. ———, I work like h——, and I can only make ——."

An adjustment was made as readily and willingly as in the other case. Thus, harmony was maintained and production increased per unit of dollar invested in plant.

The idea of cutting a price when a man (by mistake) makes over time and a quarter is short-sighted. I watch the ones whose product curves are straight lines, and nine times out of ten find a satisfactory excuse to cut the price. I believe also that a workman who has studied his job to the extent of doubling his production by the use of some ingenious device of his own contriving is entitled to and should be allowed to get the benefit of the increased output long enough to have him feel that when the price is lowered he has not been robbed. On the other hand, if the firm gets up a new labor-saving device, it is entitled to the increased output and there should be no hard feelings about the matter.

Cleveland, Ohio. H. A. PETTIBONE.

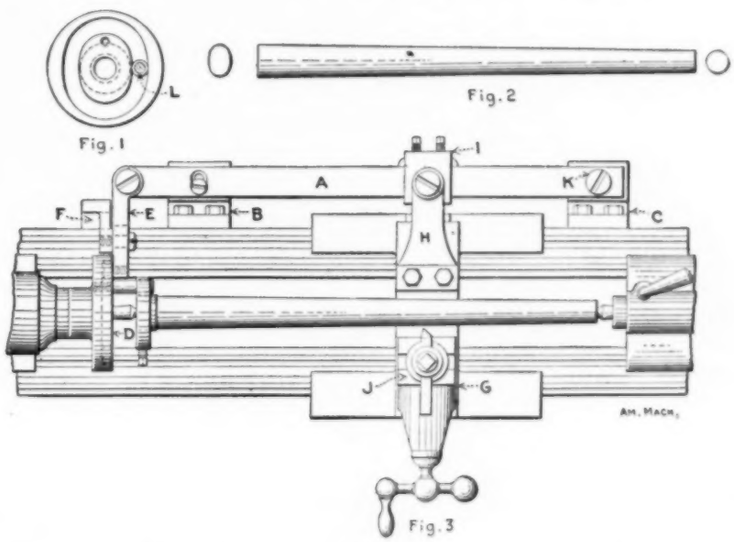
Turning a Wagon Spoke on the Engine Lathe

On page 650, Volume 34, a writer asks how to turn a wagon spoke in the engine lathe. Fig. 1 shows one of these spokes and Fig. 2 a plan of a lathe with a simple attachment for turning it. This attachment consists of a guide for it fixed on to two brackets, *B* and *C*, which are attached by screws to bed of lathe. The guide bar is fastened to bracket *C* by a stud which allows it to swivel. In the guide bar at the opposite end an elongated counterbored hole is cut at the radius from *C* to *B*; through this elongated hole passes a stud which holds the guide bar but leaves it easy to make the necessary movement when actuated by the cam *D*. This cam is a reflex of the oval end of the spoke made on a larger scale and cut on the face of an ordinary driver plate. *E* is the cam lever fastened to the guide bar at one end and on the other end is a stud on which a cam roller runs in cam *D*. Under this lever, fastened on the top of the bed, is a bracket *F* in which is a stud that passes through an elongated slot in lever *E*; this stud keeps the cam roller from leaving the path and also keeps the lever from rocking while leaving it free to move the guide bar *A*.

We now come to the cross slide of the lathe *G* to which is attached a bracket *H*; this bracket being also attached to slide *I* on the guide bar.

Fig. 2 shows a spoke in position between the centers with a little extra length left on for the driver dog, which can be cut off after the turning is finished. To make up for the extra length taken up by the lathe center and driver dog the cam must have a correspondingly greater throw. To allow cross-slide *G* to follow the motion of guide bar *A*, it is necessary to take out the cross-slide screw and use the compound rest to feed in the tool. To start turning the spoke bring the cross slide along till the slide *I* is exactly over the center of the stud *K* which should be in a line with the circular end of spoke, there being no movement on the guide bar here it consequently turns it circular. Start on the tool and put the slide feed on, the guide bar will give the proper ratio of cut to the tool. It is essential that the cam roller should be in the position indicated on Fig. 3 at *L* as the guide bar is parallel with centers in this position. WILLIAM E. SIMPSON.

Alexandria, N. B., Scotland.



ATTACHMENT FOR TURNING WAGON SPOKE IN ENGINE LATHE

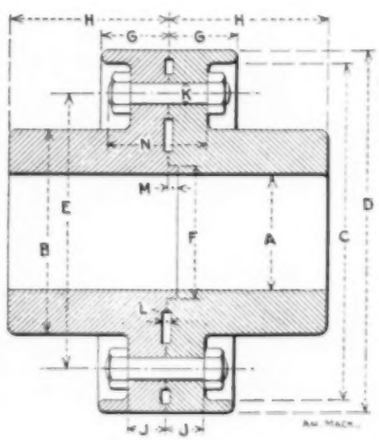
Bolts for Flanged Couplings

In reply to the article by J. O. H. on page 892, Volume 34, I beg to inform him that flanged couplings are still used a great deal at the present time on line shafting.

The formulas given by J. H. Carver, on page 585, are quite correct, and he is quite right in taking the size of shaft as the basis of the calculations.

In order to transmit power from one shaft to another by means of a flanged coupling, the diameter of shaft is first determined from the power to be transmitted.

Now, as the flanges of the coupling



Diameter of Shaft. *A*, Ins.	*B* Ins.	*C*, Ins.	*D*, Ins.	*E*, Ins.	*F*, Ins.	*G*, Ins.	*H*, Ins.	*J*, Ins.	*K*, Ins.	*L*, Ins.	*M*, Ins.	*N*, Ins.	Key, Ins.	No. of Bolts
1 11/16	3 1/2	6 1/2	7 1/4	5	2 3/4	1 5/8	3 1/2	1/2	1/2	1/2	1/2	1 1/8	1/4 x 1/4	5
2 3/16	4 1/4	7 1/2	8 1/4	5 1/2	3	1 3/4	3 3/4	1/2	1/2	1/2	1/2	1 1/8	1/4 x 1/4	5
2 7/16	4 3/4	8 1/2	9 1/4	6 1/2	3 1/4	1 3/4	5	1/2	1/2	1/2	1/2	1 1/8	1/4 x 1/4	5
2 11/16	5 1/2	11	11 1/2	8 1/2	4 1/2	2 1/4	6	1	1/2	1/2	1/2	1 1/8	1/4 x 1/4	5
3 1/16	6 1/2	12 1/4	13	9 1/2	4 3/4	2 1/2	7	1 1/4	1/2	1/2	1/2	1 1/8	1/4 x 1/4	6
3 7/16	7 1/4	14	15	10 1/2	5 1/2	2 3/4	8	1 1/2	1/2	1/2	1/2	1 1/8	1/4 x 1/4	6

DIMENSIONS OF FLANGED COUPLINGS

are held together by the bolts, those bolts will be subject to shearing stress when the power is applied. Therefore, the bolts must be of equal strength to the shaft.

If the result of a calculation gives a fraction, or decimal size, not a standard-sized bolt, use the nearest larger standard diameter.

The accompanying table, giving dimensions of flanged couplings, may be of use to some of the readers of this paper.

Toronto, Ont. C. ARMSON.

Heating Shop Floors

Some time ago I noticed in the AMERICAN MACHINIST a description of a shop that was heated by steam pipes run through the concrete floor. This was suggested as overcoming one of the objections to concrete—its coldness.

I thought at the time that it seemed a very good idea but I now have some reason to doubt it. In the shop where I work now, part of the floor is of stone and I find no objection to this on the score of hardness; but another part of the floor is of concrete and through this is run the flue from the boiler to chimney. The floor is distinctly warm here, and after standing on it for some time a very unpleasant feeling is produced in the feet. It seems to affect some of the men rather seriously, while others do not notice it so much. I fear the same effect would be produced by steam pipes.

Manchester, England. FERNS.

Progress in Nomenclature

In newly settled regions and among children names of persons have meanings of their own. A glance at any directory shows name after name whose significance is as evident as the familiar "Fatty," "Spider" of the playground. In New York City the transition from streets with significant names to numbers makes a step in efficiency which reduces geography to mathematics. In our shops we no longer tell a new man to take the third lathe from the tool room, in the second aisle from the south bench, but simply to take lathe No. 41, and we carry him in our books as No. 1472, all of which denotes progress. This being the case, is it not a little late to worry over definitions of various classes of machinery? We have now No. 0, No. 1, No. 1½, etc., millers, why not say No. 0K, No. 1K, No. 1½K? *K* signifying some type of miller. Then the orator in the Senate who wants a duty of 100 per cent. placed on something can talk about millers without conveying any definite idea of what he means, just as he does now, and the committee can insert type *K* in the list, which will definitely mean something. There is a large and growing demand for smooth sounding words with copious meanings.

All this is the result of reading Mr. Hildreth's altogether logical article on Page 895, in which he shows us conclusively that we have been talking "hindside before" for a century or more.

I cannot help feeling that it is a waste of effort to try to change this term, machine tool. Of course, if machine tools were an article of such a nature that you might 'phone the corner grocery to send over a peck, then it might be useful to pick exactly the correct name. Trade names have the least possible connection with the actual thing, as any man knows who has followed an order for eggs fried from the guest table to the kitchen of a restaurant. The fact is that the indefiniteness of some terms is their most valuable asset. We need some general terms with which to address the general public. As a matter of fact, it is difficult to recall any place where the word machine tool is used and where the meaning would be any more clear if it were changed to "tool machine."

Worcester, Mass. ENTROPY.

Guide Lines for Lettering

What does the practical draftsman think of the surfeit of guide-line suggestions that has pervaded engineering literature within the past few months? Have any of them been particularly different from those frequently met with in textbooks on drafting; have any of them proved advantageous to the man who is so employed in actual practice?

The writer has just completed the reading of about the 'steenth advice in this line, and to one who has any knowledge of custom in the drafting room, it, like many of the others, is little short of absurd; to a student it might be interesting, but the matter does not so imply. A suggestion is offered for guide-line rulings upon a piece of bristol-board, to be inserted under a tracing and so used. With consideration only of material, it is obviously certain that almost the thinnest of such stock would have a tendency to bulge the drawing, causing thumb tack tears and necessitating constant new locations, not to mention the hindrance to rapid performances, and the easily soiling qualities of the guide.

The use of a sheet of guide lines is only applicable where circumstance arises for a large amount of lettering to be executed in a particular place upon the tracing, such as a bill of material or specifications. In this instance, uniform ink rulings on tracing cloth, a sheet in size about 8x12 inches, will allow keeping the drawing flat, and result more satisfactorily to the draftsman than any other material. Unless a few such are ruled up, offering a variation in lettering hight, even this has its limits, for those suited to a large tracing will hardly be adapted to the smaller drawing.

In actual drafting work, with time at a minimum, to apply guide lines in a manner other than mentioned becomes a contradiction of the rules of practice. For illustration, consider a drawing of machine details, with parts to be enumerated and shop instructions given. The time required to shift a guide device under a tracing, arranging it first here and then there, pulling and replacing thumb tacks, would be considerable. Additionally, it necessarily demands squaring up with the work, from time to time, and its application will tend far more to retard than to assist, allowing that its use be permitted, which is greatly to be doubted. Similar conditions prevail in any branch of regular drafting, especially glaring in structural work.

The live draftsman, in practice, soon becomes so adept in lettering as to find that a single light pencil line is all that is wanted; many do not even require this. The letters, when once the knack and skill are acquired, shape themselves to size and have as much uniformity as though two or three lines were employed. The business drafting room has little use for propositions involving the workman's time, unless specifically advantageous; it is after time-savers, not time-consumers. If we deal with the young draftsman, starting out, he should be guided to see in the real light, and apply his talents accordingly.

L. R. W. ALLISON.

Los Angeles, Cal.

Enlarging the Bore of Emery Wheels

I note Daniel Melrose's device for enlarging the holes in emery wheels, described in the AMERICAN MACHINIST on page 888, Volume 34. The same results can be accomplished just as quickly and with less expense by taking two or three old files and clamping them together in a vise. When the files become worn they can be ground flat on a grinding wheel, but Mr. Melrose could not do this with his device, but would have to have another made, at some expense.

Files are used for enlarging the holes in wheels by four or five grinding-wheel makers that I know of, and I have no doubt but that the majority of them follow the same practice, as the files can be bought for a few cents per pound.

Providence, R. I. J. C. STRONG.

Diamonds for grinding purposes are sold under the trade name of bortz, some being fairly clear and showing crystal formation, while others are not even translucent, owing to so many angles to the layers. They are about equally hard, however, and break and grind up into powder or dust of about the same value. Commercially, bortz ranges from 60 cents to $1 a carat.

Turret Lathe Air Chucks and the Grinding of Hexagon Packing Nuts

In the plant of the Nelson Valve Company, Philadelphia, Penn., nearly all of the turret lathes used for machining brass valves are equipped with pneumatic chucks, similar to the ones shown on the Bardons & Oliver machines in Figs. 1 and 2.

Fig. 1 has a medium-sized chuck body with a draw-in master collet *A* into the jaws of which false jaws, shaped to hold different pieces, may be fastened with screws. *B* is an air cylinder in which a piston works, which is connected by a quill through the spindle to the collet *A*. The pressing down of lever *C* allows the air to enter the cylinder and force the piston back, closing the chuck. Throwing the lever back shuts off the air from the supply pipe and allows the air in the cylinder to escape, which opens the chuck. Lever *D* is used to start or stop the machine by means of the chains *E* and *F*, running up to the countershaft. Fig. 2 is practically the same, except that the chuck used is larger and the collet is of different form, the lettering being the same for both halftones.

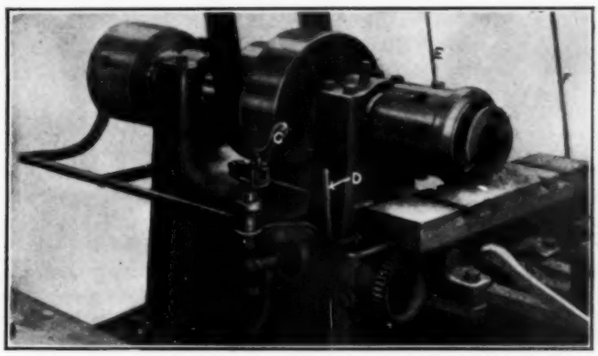


FIG. 1. PNEUMATIC DRAW-IN CHUCK FITTED TO TURRET LATHE

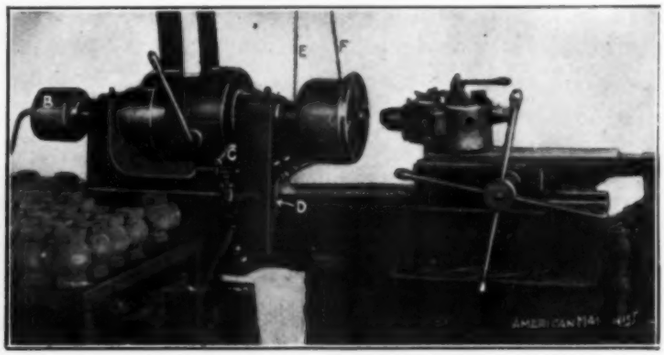


FIG. 2. SAME TYPE OF CHUCK FOR LARGER WORK

A pneumatic bench vise used by the assemblers is shown in Fig. 3, which is operated in practically the same way as the pneumatic lathe chucks, the air-valve lever being shown at *A*.

FIG. 3. PNEUMATIC BENCH VISE

GRINDING HEXAGON VALVE PACKING NUTS

Hexagon valve packing nuts are ground 16 at a time on a double-disk grinder, as shown in Fig 4, the nuts being placed on pins set into a handled bar like the teeth of a comb, a hinged end piece holding them on the pins. This jig is then placed between the disks and two sides of the nuts ground, then they are shifted one-sixth of a turn and two more sides ground, three shiftings completing the job in a fraction of the time that would be required by the milling process.

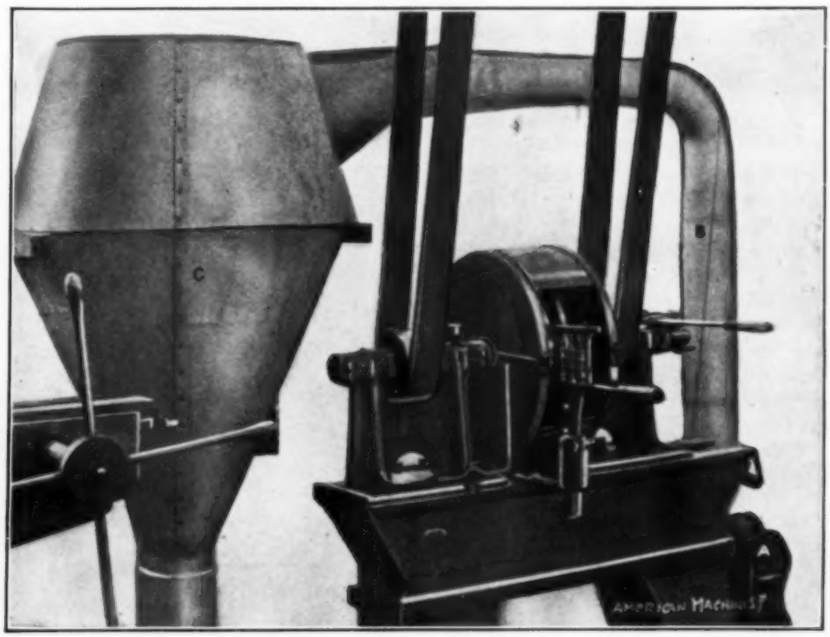


FIG. 4. DISK GRINDER AND DUST SYSTEM

The halftone also shows the individual dust system used on this particular machine, *A* being the motor running an exhaust fan connected by piping to the disk hood, and *B* the pipe leading from the fan to the dust bin.

The Turin Exposition Power Plant with Less than 12 Per Cent. Steam Engines

The tendency to break away from the piston steam engine is evidenced by the power plant of the Turin exposition, which has a 600-horsepower compound by Tosi, of Legnano, and a 500-horsepower vertical by Swiderski, of Leipsic. Tosi has a 4500- and Swiderski a 1200-horsepower steam turbine, and Tosi a 600- and a 1200-horsepower oil engine; Sulzer Brothers, of Winterthur, and Longan & Wolf, of Milan, have an oil engine of 1000 and 450 horsepower respectively.

Thus in a total of 10,000 horsepower the piston steam engine has but 1100 against 3300 for the oil engine and 5700 for the steam turbine. There are no gas engines in the exposition.

Of course, the tendency is to exhibit and feature the new rather than the old, but such a power plant would have been undreamed of a few years ago.

Making a Combing Roll

One of the interesting things in connection with the making of textiles is the combing of the material by what seems to be a series of saw teeth on a cylinder.

These are made in different ways, some being punched from circular disks and held on a cylinder with washers placed between them. In one of the styles of machines made by the Curtis & Marble Company, Worcester, Mass., these are formed in an entirely different way. As can be seen in Fig. 1, the long shaft is first cut with what is practically a thread of the right size to receive a strip of soft steel which has the teeth cut on one edge. These strips, a section being shown in Fig. 2, are cut very rapidly under a punch press and wound on reels as can be seen at the end of the lathe.

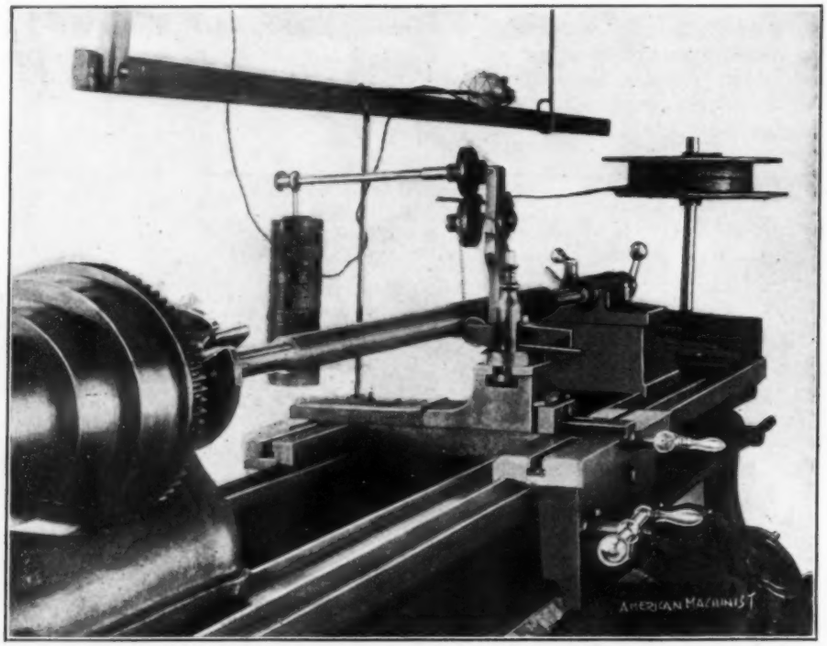


FIG. 1. ROLLING IN THE COMBING STRIPS

From here it is run between the two rollers shown, the desired tension being secured by the weighted arm connected with the upper roller, and the tooth strip is fed into the thread already cut into the bar. Following this, as it is wound into the threaded groove, is the substantial roller tool, shown in the tool post, which forces the metal of the bar down against the side of the strip and holding it firmly in place by what is practically a peening process. The tension rolls are supported on an upright which is fastened to the tool block of the carriage so that they feed along together and, in this way, the strip is securely fastened at a comparatively rapid rate.

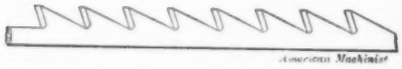


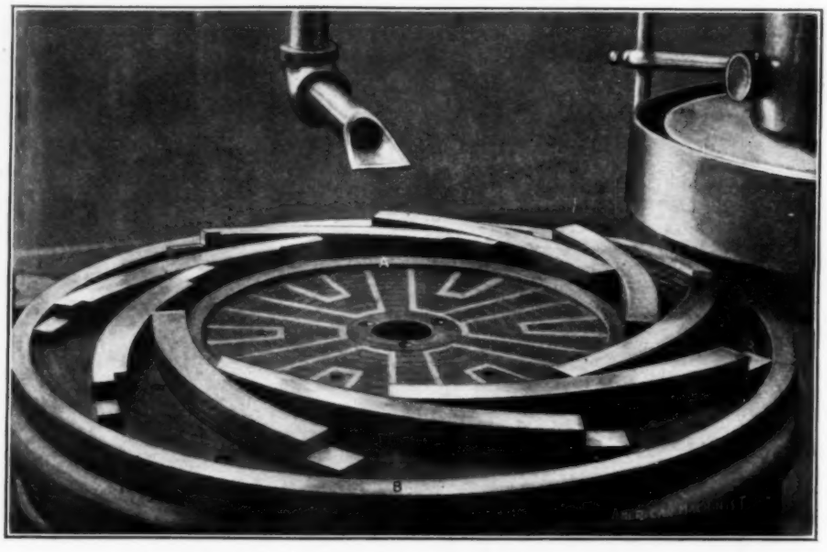
FIG. 2. A SECTION OF THE COMBING STRIPS

Grinding Piston Rings

The illustration shows an interesting method of grinding piston rings on the Blanchard vertical-spindle grinder. Rings *A* and *B* are used to assist holding the ring sections in place, the former being held entirely by the magnetic chuck surface.

By placing the piston-ring sections in the manner shown, they receive the steadying effect of both the inner and outer rings and at the same time wedge against each other so that when they are drawn down by the magnetic chuck, they are very firmly held and can be easily ground to a perfectly flat surface.

This suggestion should be available for holding other work and shows very plainly that even with the best of equipments, the ingenuity of the operator has much to do with successful production.



GRINDING PISTON RINGS ON VERTICAL-SPINDLE GRINDER

Private Information

BY E. H. HENRY

Take almost any shop employing skilled mechanics and close investigation will show that every foreman and every machinist has some information locked up in his cranium that ought to be in the possession of the manager, but is not. This information may range from the knowledge that there is a vital error in some drawing that must be allowed for, to the knowledge as to which one of the lines on the tailstock is the proper one to set to to turn straight. Many men consider these things assets of their own and believe that the possession of such knowledge helps them to retain their positions, not realizing that their employers are not aware that this information is in existence.

Any man may be reasonably sure that it is much to his advantage to furnish records or reports of all these things to the management, and that whatever he can do in that direction will redound to his credit, in some shop if not in the one in which he may happen to be employed.

The information belongs to his employer, he has paid for it and as a matter of mere policy it should be delivered. If it is not delivered it will have to be sought by the employer, and is being sought more and more persistently. If found in the possession of some "trusted employee" it will not prove an asset.

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Of this issue 23,250.

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OUTLINE OF TOPICS, PAGE 145

American Machinist

What is Meant by "Technically Educated Man"

A correspondent writes us in regard to advertisements for men, stating that many of these specify "wanted a technically educated man," or make use of some expression that has a similar meaning. He says that he has never had an education in any of the technical schools of this country, but that he has studied nights, has read the leading technical publications, has been entrusted with much important work, and has frequently demonstrated his ability to turn out more and better work when placed alongside of technical graduates. He asks further if the use of an expression specifying a technically trained man is not unfortunate both from the viewpoint of the employer and the applicant; the first may not receive application from men who would be suited for the work in hand, simply because they are not graduates of engineering schools, and the other may fail to apply for positions for which he is well fitted, because he cannot meet to the letter the provision of the advertisement.

There is a great deal of justice in this position.

Undoubtedly in many cases the way to construe this requirement is to add the phrase found in so many specifications "or its equivalent," thus making it read: "Wanted a technically educated man, or man with equivalent education."

The employer wants a man capable of doing his work, and in the majority of cases does not care whether he has a technical education or not, provided he is technically fit. The easiest way for him to specify this requirement is to ask for a technically educated man. With this interpretation it is evidently in order for a man to apply for a position for which he believes he is qualified and for which he can meet the specification in spirit if not to the absolute letter. However, in making such application he should distinctly state the way in which he fails to meet the exact letter of the requirement.

Misfit Machinists

The problem of fitting the different pegs into the holes for which they are adapted is being more seriously and intelligently considered than ever before. As usual in matters of this kind, Massachusetts is in the lead with her vocational bureau under the direction of Meyer Bloomfield, who has long been connected with work along these lines.

As a result of this work, teachers in and around Boston are learning how to study the natural tendencies of their pupils, and to advise them far more intelligently than formerly, regarding the vocation it is advisable to follow.

This work involves collecting data regarding different trades, such as physical and mental requirements, opportunities for advancement, hours, wages and similar conditions, so that boys and girls may know something definite to look forward to.

While such a work must of necessity be slow, anything which tends to prevent square pegs from getting into round holes, will be welcomed by every progressive manufacturer. He knows all too well the inefficiency of workers who have little aptitude for the tools.

There are many men working in machine shops who would make better barbers, cooks, artists or musicians than they do machinists and be far happier. But, through lack of knowledge or the necessity of getting a job, they drifted or were forced into the shop to become misfit machinists. And, after working at any line a few years, it becomes very difficult to change. Another case where an ounce of prevention is worth a pound of cure!

Any man is more efficient when working at something he likes, and if every man in the shop had inborn mechanical tendencies, that shop would have a marked advantage. With every man interested in his work, the production would increase in both quality and quantity, and the men be happier than at present.

Misfits are a detriment to any trade as well as to themselves, and any movement which will tend to improve conditions in this respect will be welcomed by progressive men in all lines.

Setting up Plans for Machine Tools

Frequent practice in regard to furnishing setting-up plans for machine tools is to make use of a type blueprint either for each size of a given kind of machine, or for a given kind of machine with suitable dimensions filled in for the size being shipped. It is doubtful if many of these plans furnish all of the information that the purchaser needs.

A common omission is the size and location of projections. Others are the location of the countershaft driving pulleys with reference to the base of the machine, and the minimum clearances required to remove parts of the machine in case of repairs.

Receiving pits and openings for the removal of chips are frequently neglected, necessitating additional expense and construction after the machine is in use. The matter of foundation bolts is often left in a haze. There are many machines which require no foundation bolts at all, provided they are set on a concrete foundation or concrete floor and grouted into place. This is a point upon which the setting up print should be specific. In this same connection are pits and openings for elevating screws, or parts that must pass at times below the normal floor line. It is often not self-evident from a glance at the machine whether or not these parts do go below the floor level, and if they do, how great is their travel? If head room below is important, it is something of a task to jack up the machine sufficiently to determine this travel by actual measurement of the parts, or to approximate it by measuring the machine with the members in ordinary working position.

Still another point; while the speeds of pulleys in countershafts are usually given, much less care is taken to show the direction of rotation of all of the pulleys. This is a question which the man who is setting up always has to settle before he can finish his job.

A mechanical engineer who has had a vast amount of experience in setting up

machine tools, gave as his opinion that there are very few setting-up plans that give all of the information required by the engineer or millwright who is putting the machine in place. Such prints should be considered as applying not merely to a type of machine, but to every individual of every size, and should be accurate for those conditions. They should be considered as serving not only for the original setting up, but for filing away in case of need if the machine is moved from one department to another, or from one shop to another. The old saying that if you make a machine part too strong nobody knows it, but if you make it too weak everybody knows it, can be paraphrased in this connection, thus: If you give too much information on a setting-up print, nobody knows or cares; but if you give too little, somebody knows and most decidedly cares.

Vigilance in Safety Devices

It is not enough to merely design and put on safety devices to protect employees. That is a splendid start but only half the story—perhaps only a third.

Another third is to keep the devices on the machines and in good working order. One company prints this admonition on all its orders for repairing machines, "Replace all safeguards before leaving the job."

The final point is in connection with the man.

Whenever a man is hired into a department, or transferred from some other part of the works, or changed from one machine or job to another, he should be specifically told of the points of possible danger, shown the safeguards and their uses and instructed how to avoid accidents in doing his work.

Here, as elsewhere, we need to apply eternal vigilance.

New Publications

PRINCIPLES OF SCIENTIFIC MANAGEMENT. By Frederick W. Taylor. 144 pages, 5½x8¾. Harper & Brothers, New York and London. Price, $1.50.
See page 108.

INDUSTRIAL PLANTS, by Charles Day. Two hundred and ninety-four 5x7½ inch pages, 48 illustrations, two folding plates. The Engineering Magazine, New York, and London. Price $3.

The object of this book is both descriptive and argumentative; descriptive in the sense that it deals in considerable detail with the large amount of provisional data necessary before a modern industrial plant can get itself satisfactorily housed, and argumentative in the respect that its author's main object is to emphasize the necessity of "looking before you leap" when the erection of a new factory is in question. In writing this book Mr. Day has unquestionably rendered great service to industrial managers.

Though he has an irritating habit of introducing symbolic classifications such as "P-j," or "M-(3) a, b, c, d, e," at the head of his most important paragraphs, the book is written in a clear style and forms a good resumé of the large number of factors that enter into the construction of industrial plants. Its principal fault is a tendency to over-elaboration, such as in the chapter on machine shops, where much space is devoted to the discussion of details only remotely connected with the design of plants.

Chapter I is mainly introductory. Chapter II deals with the determination of the specific requirements of the proposed business. Chapter III deals with selection of sites, types of building construction, layout, etc., and comparison with financial limitations. Chapter IV discusses preparation of plans and specifications. Chapters V and VI deal with getting bids, making the contract, and starting up. Chapter VII is one of the most interesting, as it deals, by the aid of diagrams, with the important question of "routing" and emphasizes the importance of having a clear idea of the proper succession of the different stages of manufacture, and providing accommodation accordingly. Chapter VIII on "Characteristics of Metal Working Plants" is rather disappointing. It mixes up its proper subject with dissertations on employment of labor and elementary remarks such as "As machines are not automatic, there are usually a number of different methods by which given operations can be performed." This fairly obvious fact is used, however, by Mr. Day to introduce a very doubtful deduction. He goes on to say "but only one of these represents maximum efficiency." The bearing on building construction of this sort of statement is none too close and it would have been better omitted. Another sonorous platitude of the same kind is "The efficiency with which machines operate depends on the degree to which conditions representing maximum economy are maintained."

Having already given some attention to machine-shop construction in the eighth chapter, Mr. Day devotes chapter IX to the "Specific Requirements of Machine Shops." One might almost read through this chapter without guessing that it had any bearing on the subject of constructing industrial plants. According to the author it has been written to "exemplify that kind of detail knowledge which should be possessed by engineers who arrange, plan and construct industrial properties." This seems a strong statement. If so, then no one can construct a shoe factory without having an exceedingly close knowledge of the shoe trade in the most minute detail. For this chapter deals, in a classificatory way, with such matters as speeds, feeds and cuts, power required for different types of machines, the eleven "shop considerations bearing upon machine drive" one of which we note with great interest and some incredulity is our old friend "functional management." The work of Mr. Taylor, Mr. Gannt and Mr. Barth is referred to in more than one place, and we are told that "the true import of this work was not appreciated by shop managers generally, until they were confronted with the wide differences existing between the amount of work that could be accomplished in connection with modern equipment operating under best conditions and the figures of *average* results secured in their shops with the same kind of equipment." We believe some shop managers are even yet unconvinced. The three remaining chapters are devoted, respectively, to some characteristic examples of modern plant construction, to demonstrating the value of the expert's services and the need for remunerating him handsomely.

Taking the book as a whole it contains a great deal of very useful matter, profitable to all who contemplate building new plants. But the author's tendency to discursiveness is somewhat too evident.

Personals

Edward Rivett, president of the Rivett Lathe Manufacturing Company, Brighton, Boston, Mass., sailed for Europe on July 13 for a six weeks' trip.

Joseph Borovitz, until recently factory manager and chief engineer of the plant of Adams Brothers Company, Findlay, Ohio, has accepted a similar position with the F. A. L. Motor Company, Chicago, Ill.

Alonzo Pawling, president and treasurer of the Pawling & Harnischfeger Company, Milwaukee, Wis., and for many years a prominent figure in the machinery field of this country, has disposed of his interests in the company, and has retired from business life. Mr. Harnischfeger becomes president and treasurer; W. H. Hassenplug, vice-president; F. P. Breck, second vice-president and S. H. Squier, secretary.

Obituary

Oscar J. Beale, for many years gear expert with Brown & Sharpe Manufacturing Company, died on Sunday, July 16. A notice of his life and work will be published in next week's issue.

H. F. Frohman, general manager of the S. Obermayer Company, Cincinnati, Ohio, died on July 15. Mr. Frohman was a native of Cincinnati, and was connected with the Obermayer Company since 1886. He was secretary and treasurer of the old company and on reorganization in 1901 he was elected general manager and treasurer.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Diamond Speed Shifter

The diamond speed shifter, shown by the engravings, consists of a steel tube, extending from the machine to the ceiling and pivoted at both ends to turn freely. Attached to the upright tube, in a position convenient to the operator's hand, is a lever and attached to the tube, also, in a position suitable to engage the belt, close to the countershaft cone, is a short arm, the outer end of which forms a loop, through which the belt runs.

The operator desiring to change the speed of his machine, merely pulls the

FIG. 1. DIAMOND SPEED SHIFTER

lever attached to the upright tube. This action forces the loop, and with it the belt, around behind the next higher step of the cone, when the belt is instantly engaged by the revolving pulley and drawn into position for the next higher speed. To decrease the speed, the lever is pushed instead of pulled. This reverses the action of the loop arm, and pulls the belt from the higher to the lower step of the cone. The shift from a higher to a lower or a lower to a higher speed may be accomplished instantly, while the tool continues cutting. This simple device prevents waste of time, which is unavoidable where the old "shifting pole" method of changing speeds, still prevails.

It also acts as a safety device in preventing injury to the workman's hand, which may be caused by the belt when shifting by hand from one speed to another. Furthermore, the device is applicable as a safeguard in preventing the accidental starting of the machine by the shifting of the countershaft belt from the loose to the tight pulley. In Fig. 2 the arrangement for this purpose is illustrated.

Here the device is attached to the rear end of the lathe and a link connects the overhead rod with the shifter rod and belt forks. In order to shift the belt onto the fast pulley the handle of the

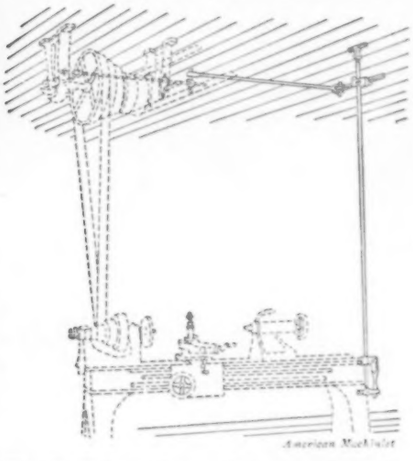


FIG. 2. BELT SHIFTER ARRANGED TO CONTROL THE COUNTERSHAFT ON THE FAST AND LOOSE PULLEYS

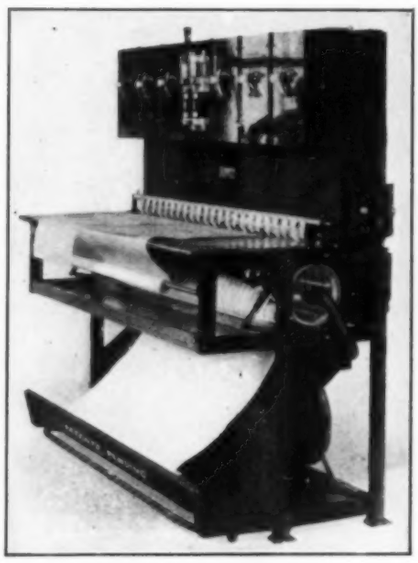
device must be raised from its locked position and turned sufficiently to operate the overhead shifter rod. Upon stopping the machine again the handle locks the belt shifter in position where the countershaft cannot be started without again lifting the controlling handle.

This device is manufactured by the Diamond Iron Works, Minneapolis, Minn.

A Blueprinting Machine

The halftone shows a blueprinting machine, built by the Revolute Machine Company, 417 E. Ninety-third street, New York.

The machine is equipped with six high-power arc lamps, will print continuous rolls or separate cut sheets, the paper traveling across the feed table with the tracing on top, and is carried with the tracing by suitable guides, around the top roller and onto the surface of the revolving glass cylinder, between the glass and a set of 38 endless canvas belts. These belts hold



A BLUEPRINTING MACHINE

the paper and tracing in close contact with the cylinder through one-half revolution, during which time the printing is done; the print and tracing then drop into the chute and are caught in the trough at the bottom. It is made only in one size, printing 57 inches wide, and the speed of paper through the machine varies with the different tracings and paper and with the nature of the supply current.

Six lamps, operating at 10 amperes each on direct current of 220 volts will print the rapid electric papers through new tracings at 20 linear feet per minute, and usable prints can be made much faster.

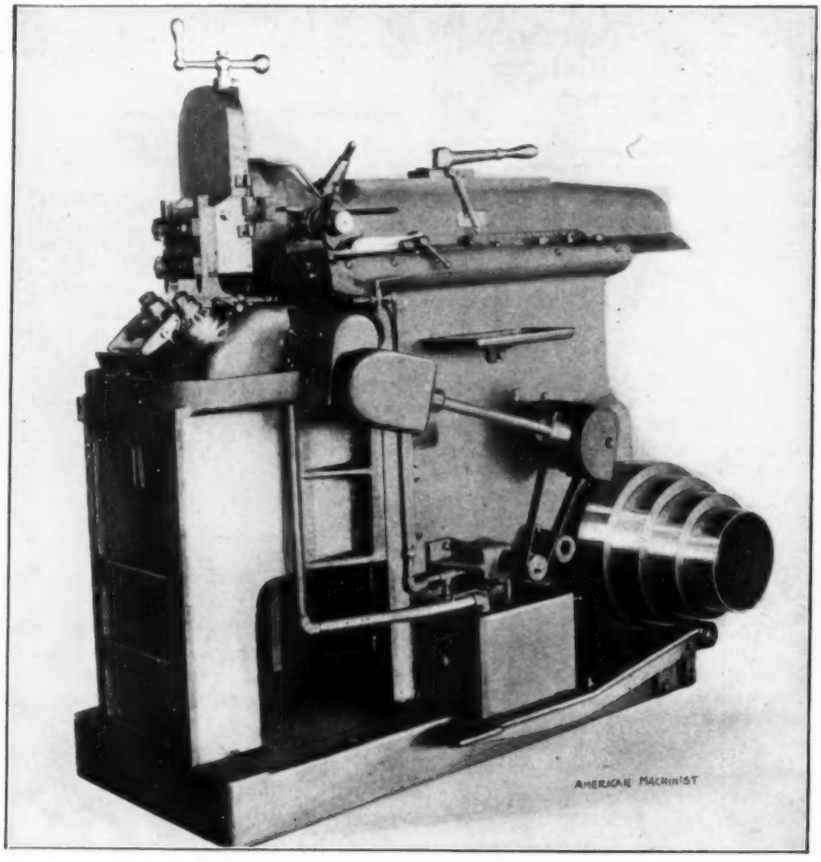
The speed of the machine is controlled by a lever, which connects with a friction drive.

Bevel Gear Roughing Shaper

The illustration shown is a bevel-gear roughing shaper, designed by Gould & Eberhardt, Newark, N. J. The principal function of the machine is to take care of the roughing or stocking out of bevel gears preparatory to having them finished on a bevel-gear planer.

This machine is particularly adapted to roughing out automobile differential steel bevel gears that have projecting hubs on the cone or small end of the gear.

To accomplish the above work, the high-duty shaper lends itself very well on account of its high number of metal removing strokes made possible in this machine by a double train gear drive, and has been modified so as to allow one or two bevel gear blanks to be rigidly held at the proper angle and indexed at every return stroke of the ram while the shaper head is automatically fed down at each stroke until the proper depth is reached, and then the feed is automatically thrown out and the blanks removed. The machine makes 100 cutting strokes per minute.



BEVEL GEAR ROUGHING SHAPER

In this machine the regular crosshead slide and table have been removed and a special work head with an indexing mechanism has been substituted in their place. This workhead may be arranged so as to cut one or two gears at a time up to the capacity of the machine with suitable means for holding the blanks rigidly, and lubricating the tools, and so they can be removed very rapidly when finished and replaced with new blanks. The illustration shows two nickel steel 20 T- 5/7 pitch bevel gears being roughed out at one time in 6 minutes or 3 minutes each. They have projecting hubs and to remove the chips that accumulate in the groove between the projecting hub and the inside face of the gears, two hook tools have been provided that fit in the groove, under spring tension, and which can be easily thrown out of position when taking off the gear.

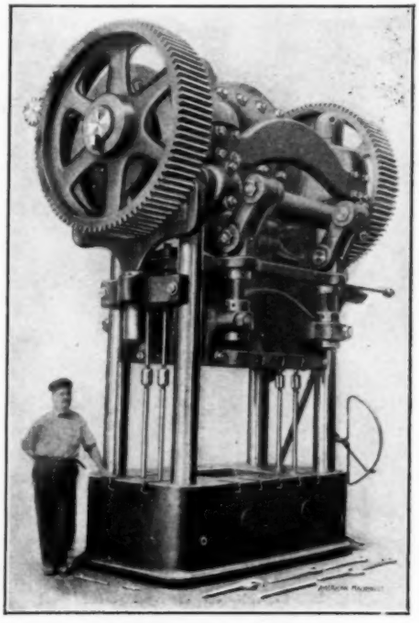
The indexing of the blank from one tooth takes place at every return stroke of the ram; that is, when the tool is clear of the work and is, therefore, positively controlled by the reciprocating of the ram. After the indexing has taken place and before the tool engages the work, means are provided to lock the work spindles so that the blank is securely held while undercut.

As the ram returns and the tool is out of the cut, the automatic vertical feed to head takes place and so continues to operate until a small trip dog located on one side of the head and which must be previously set to feed the tool to the proper depth, disengages the feed. A large foot brake is arranged to act on the driving pulley and enables the operator to stop the machine instantly. An automatic oil pump and large oil reservoir are regularly furnished and the machine weighs about 4300 pounds.

Toggle Drawing Press

The press shown herewith was designed primarily for deep double-action work, such as automobile brake drums, gear cases, dust covers, etc., but may be used as a single-action press, thereby giving it a greatly increased capacity.

The base is an iron casting internally ribbed and trussed. Projecting upward from the corners of the base are four steel columns, each being 9 inches diameter, which is considerably in excess of what is necessary from a standpoint of strength, the additional metal serving to stiffen the entire construction. These columns fit into true bored holes in the base and are firmly secured thereto, being connected at the top by heavy castings, the end stays containing the journal bearings for the shaft. The columns serve as slide bearings for the ram, in addition to their main function, which is to take the tensile stresses.



TOGGLE DRAWING PRESS

The shaft is a heavy steel forging, having a diameter of 12½ inches at the journals and 15 inches at the crank. Keyed to the ends of the shaft are steel gears with cut teeth. A cam groove in one of the gears gives vertical motion to the yoke at the left of the machine. The yoke gives a partial rotary motion to the toggle shafts and they in turn drive down the ram, the plunger or inner ram being driven by a crank at middle portion of the shaft.

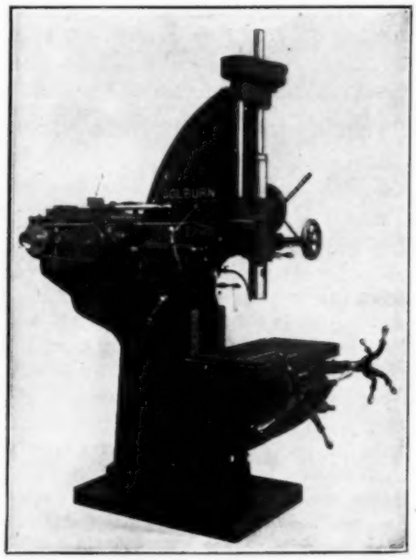
By disconnecting the toggles at front and back, the machine is changed into a long-stroke single-acting press, the upper die being attached to the plunger.

The machine is a recent product of the Ferracute Machine Company, Bridgeton, N. J., weighs about 70 tons and exerts a pressure of 1000 tons.

Improved Heavy Duty Driller

The Colburn Machine Tool Company, Franklin, Penn., has lately made some improvements in its line of heavy-duty drillers described in detail at page 1189, Volume 33, Part 1. The illustration shows the D-3 size machine, which has a capacity for drilling three-inch holes with high-speed drills in solid steel.

The first machines had a right-angle drive, necessitating the use of quarter-turn belts when a number of machines



HEAVY DUTY DRILLER

were set in a row and driven from one line shaft.

This is now changed, so that the main driving shaft in the speed box, on which is mounted the driving pulley, sets parallel to the line shaft. This allows any number of machines to be set in a row side by side and belted with straight belt direct from one line shaft.

The speed box is an entirely new design. It is mounted upon a substantial extension or knee at the rear of the main column. There are eight changes of speed obtained through sliding gears and positive clutches. All speed changes are made with the two levers *E* and *Z* which are within easy reach of the operator while standing in front of the machine. Four speed changes are made with lever *E*. All the gears in the speed box are made of steel and the corners of the teeth beveled where they slide together. Gears subjected to the heaviest strain are hardened. All bearings have bronzed bushings. The feed box is so designed that it forms a tight non-leakable oil reservoir. A target *I*, on top of the speed box in plain sight of the operator, shows which gears are engaged. A set of back gears increases the speeds to eight and these are engaged and disengaged by means of lever z.

The machine is driven through a friction-clutch pulley operated by means of lever *G*. The gears run at a high rate of speed and it is impossible to make the speed changes when driven by the regular clutch pulley on account of the severe impact caused by too sudden engagement of the gears and clutches. To overcome this, an auxiliary friction clutch is interposed between the main friction pulley and the gears in the speed box. This auxiliary friction is operated by means of lever *F* and by its use the gears are made to turn very slowly and the different speed changes can be made without jar.

The different speeds and feeds and the combination by which they are obtained are shown on a speed and feed index plate attached to the feed box in plain sight.

The feeds, of which there are six, are obtained by means of the pull rod *X*, operating the back gears and the pull rod *W* operating the dive key.

In addition to the graduated-dial automatic feed-tripping device another safety trip is added which automatically trips the feed when the spindle has reached its lowest position. This prevents possible accident of feeding down too far.

To arrange the machine for motor drive a special bed plate having an extension for the motor is provided. The motor sits directly under the clutch pulley to which it is belted. The clutch pulley allows the machine to be stopped and started without stopping the motor. This machine is built with either standard bracket type of table or with compound table as shown in the illustration.

Semi Automatic Rivet Driller

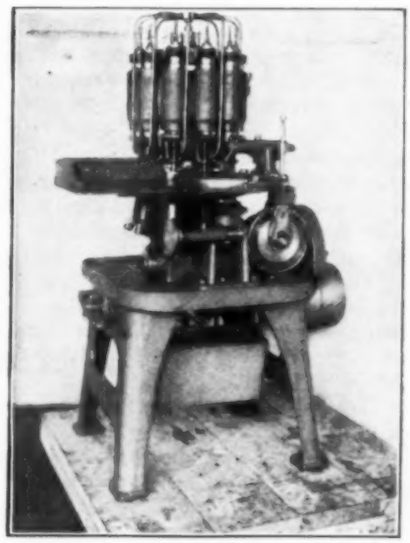
The machine shown herewith has been designed and built for drilling the ends of solid rivets of various styles into a tubular form.

There are nine drilling spindles constantly working and one rivet-loading or inserting spindle. A simple and quick hand feed is used and the output is fifty soft-steel rivets drilled per minute with hole 0.17 diameter and 7/32 deep.

The accompanying illustration shows the front or operator's side of the machine. The construction of the machine consists of a one-piece column of ten drilling heads revolving at the rate of five revolutions per minute around a central stationary upright post, which is cast in one piece with the table. Each drilling head is provided with a drilling spindle, running in a two-piece feed quill of such construction as to allow the drilling pressure to be overcome, should hard rivets be encountered and thereby preventing the stalling of machine or breakage of drills. On the inner side and at the top of each feed quill is located a roll which holds contact by a compression spring with a rim-feed cam fastened to the top of the central post.

The means of adjustment for different depths of holes and for taking up the wear of the drills are at the top of the central column. The rim cam is adjustable vertically to allow rivets of different lengths to be drilled.

Each drilling spindle is driven by a fiber pinion, the ten pinions meshing with a common central driving gear, the shaft of which passes downward through the center of the central post and connecting by bevel gears to the pulley-driving shaft.



SEMI-AUTOMATIC RIVET DRILLER

The column is driven by a worm and gear, the worm shaft being connected by a pair of spur gears to the pulley shaft.

Each drilling head is provided with an anvil and a clamping vise jaw for holding the rivets during the drilling. The vises are opened and closed at the proper time by bell crank levers, the lower end of which is provided with a roll that has contact with a stationary plate cam. This cam is adjustable to allow the vise jaw to clamp rivets with heads of different thicknesses.

The rivets are automatically carried to the vises by the rotary movements of a circular friction dial and are fed automatically into the vises by a push finger that derives its motion from a cam, the shaft of which is operated through a pair of spiral gears by the worm shaft. The rivets are ejected by a stationary thin sheet-steel finger that reaches into the vise opening and wipes them out as they pass by. Oil is forced to the drills

by a Brown & Sharpe oil pump, the oil being carried through the middle of central gear shaft to a distributing head at the top, where it is led to each drill individually through oil tubes.

The machine occupies a floor space of about 32x39 inches, weighs 1600 pounds and is built by the Langelier Manufacturing Company, Providence, R. I.

The College Graduate

By Entropy

There is an idea most prevalent at about this season of the year to the effect that a man with a trained mind is thereby enabled to immediately grasp the details of any hitherto unknown trade or profession. No doubt some thousands of young men have just graduated from school with the firm conviction that all that is necessary for them to do is to grasp the world by the heels and shake a living out of it. Yet many will have to begin with a very modest shake and some quick dodging to keep out of line of some lively heels. Still they believe it is only a question of a few months before they will be called before some Congressional committee in the guise of third vice-president of some Octopus. Experience teaches them nothing. They point with pride to the first vice-president of so and so and remark that he graduated in the class of umpty-ump, but they forget that he rose to that position by pure gall or by matrimony or that he waded about in the slough of despond for years before he began to rise.

There is little doubt but that a trained mind is a fine thing to have in the family but we feel a deep pity for the man who expects to make it a substitute for exact detailed knowledge, for he is sure to need a parachute or a feather bed to drop on sooner rather than later.

It will not do to assume, on the other hand, that, because a man trained in the shop cannot always give up his knowledge of details in logical form and in perfect English, he does not possess anything worthy of attention or that he is secretive about it. The trouble most likely lies in his passing over of details as perfectly obvious which are as necessary to the trained mind as to any other kind of a mind but his own.

Cincinnati Superintendents' and Foremen's Club

The superintendents and foremen of the shops in the Oakley colony near Cincinnati, Ohio, have formed a club for educational purposes along mechanical lines and will be glad to hear from the manufacturers of machinery with a view to arranging a series of lectures on subjects that will be of interest and value to all. The secretary of the club is C. W. Moon, care of the Triumph Electric Company.

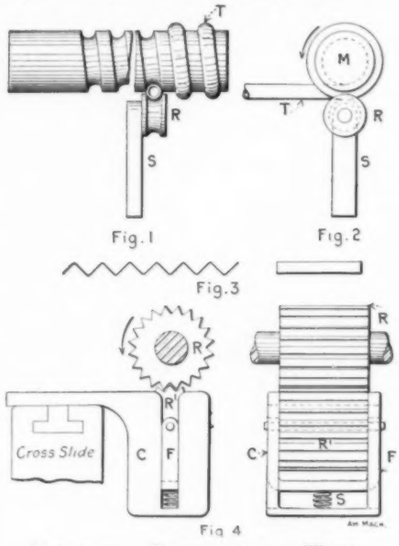
Motor Car Experimental Work

By Donald Hampson.

Figs. 1 and 2 illustrate the method used in making the coils for a steam generator; the coils being of 3/8-inch copper tubing.

M is a mandrel mounted on lathe centers and having a half-round groove cut in its face of a pitch equal to the required pitch of the coils. A shank *S* fits the tool post and carries at its free end a roller *R* also grooved and set at the angle of the "thread." To produce the coils, the roller groove was set in line with the groove in the mandrel when the gears were in and a length of tubing just caught between the two at the end of the thread and the lathe started. At *T* is shown the tubing after a couple of turns are made.

"He" wanted the dies made to form copper strips into the shape shown in



Motor-car Experimental Work

Fig. 3 which is a section of the complete strip. This invention was a radiator of improved construction requiring in its completed state 150 tubes, each made of two of the corrugated strips, Fig. 3, 17 inches long with a spacer 1/8 inch thick at each edge, the whole to be soldered together. After some discussion, covering the life of dies, their cost, rate of producing work, etc., I induced the customer to let me get out "the first 150 tubes" by a cruder method shown in Fig. 4.

A cast-iron frame *C* was made so as to be bolted to a lathe cross slide. This had a vertical slot in each side in which was fitted the fork *F*, also a casting. To do the actual work of corrugating, I depended on a pair of gears *R* and *R'*. *R* was put on a mandrel between the lathe centers and was the driver; *R'* turned freely in the fork *F* and was kept in contact with *R* by the spring *S* at the bottom.

Without the spring, the "gears," of course, would never have worked but the way the outfit turned out the finished product was a delight to see—in less than two hours the strips were all corrugated and piled up. Suitable guides (not shown) were provided for keeping the strips square with the center line of the rolls and a guard for the hands was included.

The gears were of cast iron case-hardened after cutting. To cut the teeth an ordinary face milling cutter was used leaving a square groove. This left the sides of the male portion at an acute angle with each other. The sharpness at the top was taken off with a file and much to my surprise the sides of the copper strips were almost square with one another though alternate sides were of a slightly increased length due no doubt to the fact of the gears not having a drive independent of themselves.

[It would seem necessary to have something to hold the end of the tube and keep it in contact with the grooved mandrel in Fig. 1 to prevent it from springing away again.—Ed.]

A Simple Test for Parallelism in a Lathe

By John B. Uhl

I have in my kit, a piece of 5/16-inch drill rod, 18 inches long. One end is pointed and in the other end is a very small center hole.

I put on the driver-plate and chalk a spot on it about three inches from the center and bring the tailstock up so that I can scribe on the chalked part with the point of the rod while the centered end rests on the tail center. Bringing the chalked spot to the front I scribe a line on it, and then turn it around half a turn and scribe another one. If the two lines made at front and back coincide, the spindle is in horizontal alinement.

If the second line lies outside the first the lathe will bore large at the back of the hole and *vice versa*.

Vertical alinement can be determined by putting the chalked spot at the top and turning it down to the bottom and scribing lines.

Knowing where to expect trouble, we can then make allowances and take precautions.

Less Work Done on Monday

In a certain Dresden bottle factory, the amount of work done on Monday, just after the so called "day of rest"—as readily ascertained by the time cards of the piece-work hands—is 29 per cent. less than the average done on the five other days of the week. In an umbrella factory in Köln (Cologne), it is 16 per cent. less; in an iron works, 8.5 per cent. less. In mines, however, the difference is much greater, the turnover being only about half as much.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

Oxford Paper Company, Rumford, Me., will erect a new machine shop.

The garage of Bullock & Goodwin, Biddeford, Me., was destroyed by fire.

The blacksmith shop of Samuel Shaw, Hadley, Mass., was badly damaged by fire.

Permit has been granted to Isenberg & May to erect a garage at 152 Sumner avenue, Springfield, Mass.

The State of Massachusetts contemplates the expenditure of $18,000 for improvements in the machine shop and an addition to the laundry of the Monson (Mass.) State Hospital.

Fire destroyed the machine shop of Chadwick & Trefethen, the plumbing and steamfitting shop of James W. Barrett, automobile sales and repair shop of Chas. E. Woods on Bow street, Portsmouth, N. H.

MIDDLE STATES

Mrs. R. M. Englander, Cleveland, Ohio, will erect an auto garage.

The City Forge and Iron Works, Dayton, Ohio, will enlarge its plant.

Roy Brown's garage, Wilmington, Ohio, was destroyed by a recent fire.

The Mosler Safe Company, Hamilton, Ohio, is enlarging its pattern shop.

The Cudahy Packing Company will build a car-repair shop at Calumet, Ind.

The Cleveland, (Ohio), Taxicab Company will erect a large commercial garage.

Improvements will be made to the plant of the Fremont Stove Works, Fremont, Ohio.

The Lewis Spring and Axle Company, Jackson, Mich., is erecting a new $60,000 plant.

Chicago (Ill.) Metal Covering Company, 2733 Lake street, is building a new factory.

The Republic Metalware Company will erect a seven-story addition to its plant at Buffalo, N. Y.

J. R. Madden & Sons will establish a commercial garage on Market street, Zanesville, Ohio.

The Dayton Motor Car Company, Dayton, Ohio, is building an extension to its North Dayton plant.

The A. T. Nye & Son Company (founders), Marietta, Ohio, will build an extensive addition to its plant.

The Stearns Automobile Company, Cleveland, Ohio, will add some new equipment to its present plant.

The Norwalk Drilling Tool Company, Norwalk, Ohio, doubled capital to make improvements to its plant.

Babcock Electric Carriage Company is building a one-story addition to its factory at Black Rock, N. Y.

The Mark Manufacturing Company (tube works), Zanesville, Ohio, will install some new pipe machinery.

William L. Higgins will build a garage at Thirty Third street and Washington boulevard, Indianapolis, Ind.

The Wright Brothers, of Dayton, Ohio, have just completed the second building for the manufacture of aëroplanes.

The United States Cast Iron Pipe and Foundry Company will make improvements in its foundry at Addyston, Ohio.

A permit has been issued to Doctor Greenway for the erection of a brick garage at 346 Main street, East, Hamilton, Ont.

The Sinker-Davis Company, Indianapolis, Ind., founders and machinists, are in the market for mechanical equipment.

A. & O. Frerk, 3037 Lee street, Chicago, Ill., will build a brick garage for public repairing and install new machinery.

The McCormick Manufacturing Company, of Dayton, Ohio, is building a new factory for the manufacture of plumbers' supplies.

The Big Four Railway is building a new roundhouse at Benton Harbor, Mich., to replace the one destroyed by a recent fire.

Olerick & Berry, machinists, type founders, etc., will build a four-story addition to their factory at 852-864 Larrabee street, Chicago, Ill.

The Cincinnati Steel Castings Company, Cincinnati, Ohio, has doubled its capital stock and will make improvements to its plant.

The Noyes Manufacturing Company, of Dayton, Ohio, manufacturer of dies, jigs, tools and die castings, has moved into its new factory.

The Bantam Motor Truck Company, Detroit, Mich., has been organized with $100,000 capital by Hiram H. Walker, Geo. D. Bantam, Jacob M. Stookle.

The Hercules Metal Cornice Company has bought the building at Kingston, N. Y., formerly occupied by the Hays Machine Company, which it will enlarge.

G. W. Bradley's Sons, Inc., of Westport, Conn., whose plant recently burned, will locate in Peekskill, N. Y. The concern manufactures axes and edge tools.

The Buckeye Iron and Brass Works, of Dayton, Ohio, which is now erecting a new foundry, will also add a six-story factory building. The whole to cost over $100,000.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 1, for one forging press for the Brooklyn navy yard as per Schedule 3751.

The Maclaren Company, Cleveland, Ohio, has been organized with $10,000 capital to manufacture automobile parts and accessories by Don P. Miller, Harry H. Hamilton, W. R. Godfrey, etc.

The Betz-Pierce Company, Cleveland, Ohio, has been organized to manufacture and deal in all kinds of metal articles by A. B. Betz, Clifford E. Pierce, James A. Farrell, etc. Capital, $40,000.

The Quick & Thomas Company, Auburn, N. Y., has been incorporated to manufacture and deal in boilers, machinery, etc. Capital, $50,000. Incorporators, Chas. B. Quick, Cecil A. Thomas, H. A. Fitzwater.

The Henson Manufacturing Company, Springfield, Ohio, has been incorporated to manufacture patented machines for railroad usage by O. R. Henson, F. E. Townsend, C. C. Florida, etc. Capital, $10,000.

The Johnson Bearing Company, Detroit, Mich., has been organized with $100,000 capital to manufacture and deal in bearings, auto parts, engines, dynamos. Chas. O. Johnson and Hugh T. Wilson, incorporators.

The North Manchester Foundry Company, North Manchester, Ind., has been incorporated with a capital of $10,000 by I. C. F. Martin, John Stauffer and W. J. Ranger, to conduct a foundry and machine shop.

The Turner & Moore Manufacturing Company, Detroit, Mich., has been incorporated to manufacture jigs, tools and special machinery. Capital, $25,000. Incorporators, Wm. F. Turner, W. C. Moore, J. H. James.

The Globe Vulcanizing and Supply Company, Dayton, Ohio, has been incorporated to do repair work and vulcanizing on automobiles. Incorporators, W. H. Overpack, F. A. Dean, L. M. Beckett, etc. Capital, $10,000.

National Vacuum Machine Company, Dayton, Ohio, has been organized with $15,000 capital to manufacture and sell vacuum-cleaning machines. Incorporators, John G. Petosky, Theo. N. Helster, Harry N. Helster, etc.

The Holmes & Morris Manufacturing Company, Syracuse, N. Y., has been incorporated with $25,000 capital to manufacture die-casting machinery and specialties. Incorporators, F. H. Holmes, H. C. Morris, J. J. Collins.

The Perfection Spring Company, Cleveland, Ohio, has raised its capital stock to $500,000. It manufactures auto springs, and will soon make a new style of auto motor. Will move part of plant to larger quarters and increase equipment.

The Big Four Railroad will abandon its shops at Sandusky and Delaware, Ohio, at Wabash, Ind., and at Mattoon, Ill. The work formerly handled at these points will be transferred to the shops at Bellefontaine, Ohio, and Indianapolis, Ind.

The Gardner-Matthews Automobile Manufatcuring Company, New York, has been incorporated to manufacture motors, motor vehicles, etc. Capital, $100,000. Incorporators, Robt. E. Matthews, 2304 Broadway, New York; J. W. Pascon, 62 Throop avenue, Brooklyn, etc.

The Eastern Dwarf Vending Company, Newburgh, N. Y., has been incorporated with $20,000 capital to manufacture vending machines. Incorporators, Jos. H. Samelson, 17 Water street; Max Rosen, 139 Broadway; J. R. Thompson, Jr., 64 Second street, all of Newburgh.

The United States Aërial Navigation Company, Ridgefield Park, N. J., has been incorporated to manufacture aëroplanes, flying machines, etc. Capital, $1,000,000. Incorporators, Bruno H. Schmidt, 287 Summit avenue, West Hoboken, N. J.; E. E. Whittaker, 863 Madison avenue, Paterson, N. J etc.

SOUTHERN STATES

The Chattanooga Machinery Company, Chattanooga, Tenn., is in the market for mechanical equipment.

The Alloy Steel Company, Wheeling, W. Va., has been organized with $100,000 capital to construct and operate furnaces. Incorporators, W. M. Carr, S. M. Noyse, J. L. Bayha, etc.

The Grafton (W. Va.) Electric Construction Company has been incorporated with $6000 capital to manufacture electrical supplies. Incorporators, Geo. L. Abbott, W. F. Faust, J. F. Caveney, etc.

WEST OF THE MISSISSIPPI

W. P. Meadows & Sons, of Walthill, Neb., will erect a blacksmith shop.

The Seattle (Wash.) Steel Company will build an addition to its plant.

The Imperial Clock Company, will erect a two-story factory at 3419 Rutger street, St. Louis, Mo.

Burke & Farrar, Seattle, Wash., are having plans prepared for a commercial garage and repair plant.

The Standard Brass Casting Company, Oakland, Cal., has taken out a permit to build an addition to its plant.

G. L. Lynch, Sutter Creek, Cal., will build a commercial garage and repair shop. Modern equipment will be installed.

The Northern Electric Railway Company, Sacramento, Cal., is planning for the erection of new repair shops at Marysville.

The Locomobile Company of America, San Francisco, Cal., will establish a branch commercial garage for its cars at Oakland.

The San Antonio (Tex.) Machine and Supply Company will equip a plant for the manufacture and repair of gasolene engines.

The Hopkins Billing Machine Company has leased a six-story building at Twenty-Second and O'Fallon streets, St. Louis, Mo., and will equip same.

Dulmage & Smith, Portland, Ore., are having plans prepared for a new commercial garage and repair plant. Modern machinery will be installed.

H. S. Rankin, Cripple Creek, Colo., is planning for the establishment of a plant at Denver, for the manufacture of stamp mills and mining equipment.

The Elmore Automobile Agency, Portland, Ore, is having plans prepared for a new commercial garage and repair plant. Modern machinery will be installed.

Wylie Brothers Company, Portland, Ore., has secured site at the foot of Seventeenth street and will erect a plant for manufacturing irrigating and roadmaking machinery.

The Texas, New Mexico & Pacific Railway, recently organized, is planning for the erection of roundhouse and repair shops at Knowles, N. M. M. J. Healy, Tucumcari & Knowles, N. M., is interested in this corporation.

CANADA

The Canadian Locomotive Company, of Kingston, Ont., will double its plant.

The Montreal Locomotive Works will build a big new factory at Longue Point, Que.

The International Foundry Company will equip a big new plant at London, Canada.

The Positive Clutch and Pulley Works, of Aurora, Ont., is building a big new factory.

The Brighton & Niagara Spray Company will build a big new factory at Brighton, Ont.

Thomas W. Lehoe, of Fort Wayne, Ind., will locate a new automobile factory at Ottawa.

The Canadian Harvester Company will locate a new $100,000 plant at Fort William, Ontario.

The Clarke Automobile Company, of Detroit, will locate a branch factory at Woodstock, Ont.

The Cockshutt Plow Company will build a $50,000 addition to its factory at Brantford, Ontario.

The machine shops of Small & Fisher, completely destroyed by fire at Woodstock, N. B., will be reëquipped.

Messrs. Death & Watson will locate a big plant for the manufacture of electrical apparatus in Toronto.

The Calgary & Edmonton Railway, head office, Calgary, will make important extensions and will buy much new equipment.

The big garage and repair shops of W. Bauer, Georgia street, Vancouver, B. C., destroyed by fire, will be reëquipped at once.

The Algoma Central Railway, head office, Sault Ste. Marie, will require large quantities of equipment for important extensions it will build at once.

Fire did $75,000 damage to the hardware and implement plant of the Great Northern Supply Company, at Swift Current, Sask. New machinery will be procured at once.

The McGlashan Clark Manufacturing Company, of Niagara Falls, Ont., will double its plant and purchase punch presses, rolls and other machinery. The concern manufactures silverware.

GENERAL MANUFACTURING

NEW ENGLAND

Providence, R. I., will extend its sewer system.

Woonsocket, R. I., will extend its sewer system.

Wakefield, R. I., will extend its water system.

Great Barrington, Mass., will extend its sewer system.

Rowley, Mass., will enlarge its electric-lighting plant.

Paul Ackerly, Vernon, Conn., will install a boiler and engine.

Hyde Park, Vt., will add new machinery to its electric-lighting plant.

The Plainfield (Conn.) Mills Company will build two new mill buildings.

The town of Royalton, Vt., contemplates installing a water-supply system.

The town of Wakefield, Mass., is taking prices on pumps and fuel-oil engines.

C. M. Boright, Richford, Vt., is preparing plans for a water-power development.

Thompsonville, Conn., will construct a new reservoir to increase its water supply.

Marlboro, Mass., has voted $15,000 for the purpose of extending its sewer system.

F. S. Payne & Co., manufacturers of elevators, will erect a plant in Boston.

The Walpole Rubber Company will build an addition to its plant at Providence, R. I.

The Berkshire Street Railway Company will construct a new power house in Lee, Mass.

The Interlaken Cotton Mills, of Harris, R. I., will build an addition to one of its mills.

Yale University, New Haven, Conn., will build a large heating and electric-lighting plant.

The Milford (Mass.) Light and Power Company will add new equipment to its plant.

The town of Chelsea, Vt., contemplates installing gravity water supply for fire protection.

Hartford, Conn., will increase its water supply. New reservoirs, etc., will be constructed.

The city of Providence, R. I., will install two new 100-horsepower boilers in the Technical high school.

The grain mill and paper-box factory of N. E. Cutler, Wakefield, Mass., was destroyed by fire. Loss, $30,000.

The factory of the Woonsocket Wagon Company, Woonsocket, R. I., was badly damaged by fire. Loss, $20,000.

Massachusetts legislature has reported favorably on installing a new boiler in the Worcester State asylum, Worcester, Mass.

The State of Massachusetts has voted $5000 for the purpose of installing new boilers, etc., in the State prison at Charlestown, Mass.

The Lenox Water Company, Lenox, Mass., contemplates issuing $40,000 in stock and bonds for the purpose of improving its water system.

The Hygienic Corset Company has purchased the Humber shop in Westboro, Mass., which it will equip immediately for its business.

M. E. Ballou & Son will establish a canvas-basket department in their basket factory at Becket, Mass. New machinery will be installed.

The Norwich Belting Company, Norwich, Conn., has been incorporated with $50,000 capital to manufacture belting, etc. Henry L. Bennett, president; R. W. Perkins, secretary and treasurer.

The Massachusetts Agricultural College, Amherst, Mass., will install a heating and ventilation system in its new Dairy Instruction building. Architect, James H. Ritchie, 8 Beacon street, Boston, Mass.

The Boston Cold Storage Company, East Boston, Mass., is breaking ground for a nine-story factory building on New street adjoining its cold-storage plant. Heat is to be furnished from cold-storage plant by addition of another boiler. Building to be equipped with electricity.

MIDDLE STATES

Hubbard, Ohio, will soon install a municipal water plant.

The Dayton (Ohio) Art Glass Company is enlarging its plant.

The Saxon China Company, Sebring, Ohio, is erecting a new plant.

The Bloomsburg (Penn.) Hosiery Mills is erecting a large addition.

The Denmark (Wis.) Condensed Milk Company will erect a factory.

The Houff, McNeil Company, Lorain, Ohio, is erecting a large flour mill.

The Oshkosh (Wis.) Matting Company will expend $10,000 for additions.

The Lowe Brothers Paint Company, of Dayton, Ohio, is enlarging its plant.

The Sala Company, Canton, Ohio, will make additions to its power plant.

The Peerless Paper Company, Dayton, Ohio, will build a new a three-story mill.

The Dayton Fare Recorder Company, of Dayton, Ohio, is enlarging its plant.

The Dayton (Ohio) Biscuit Company is moving into its new five-story building.

The plant of the Seitz Brewing Company, at Easton, Penn., is to be greatly enlarged.

The Cincinnati Traction Company is building an addition to its Pendleton power station.

The Astaroga Power Company, Little Falls, N. Y., will erect an addition to its paper mill.

A municipal ice plant may be installed by the city of Cleveland, Ohio. A. B. Lee, city director.

The Rea packing plant, at Pittsburg, Penn., was destroyed by fire, causing a loss of $200,000.

Oswego Falls Pulp and Paper Company, Fulton, N. Y., will erect a large addition to its plant.

New additions are to be made in the power plant of the Castle inn, at Delaware Water Gap, Penn.

Peekskill, N. Y., voted at a special election to spend $90,000 for a storage reservoir or reservoirs.

The Winthrop Asphalt Shingle Company has acquired property and will build a factory at Argo, Ill.

The Scheiffle Shoe Manufacturing Company, Cincinnati, Ohio, will build an addition to its factory.

Harrison, Mich., has issued $8000 bonds to extend and improve its electric-light and waterworks system.

The grain elevator of McLane, Swift & Co., Battle Creek, Mich., has been destroyed by fire. Loss, $45,000.

The Beaver Company, Black Rock, N. Y., manufacturing wall board, contemplates an addition to its plant.

The Maning Sand Paper Company will erect a factory at Watervliet, N. Y., for the manufacture of sand paper.

The plant of the Standard Powder Works, Hollidaysburg, Penn., has been totally destroyed by an explosion.

Fire damaged machinery to the extent of $4500 in Fred T. Martin's Upper Troy Laundry, Lansingburgh, N. Y.

The Indianapolis Light and Heat Company, Indianapolis, Ind., will build an addition at Eighteenth and Mill streets.

The Republic Railway and Light Company will make improvements in its power house at Youngstown, Ohio, and other points.

The carpet and rug mill of Arthur Jones, on Jasper street, Philadelphia, Penn., was badly damaged by fire. Loss, $50,000.

The Cleveland (Ohio) Southwestern and Columbus Railroad Company is planning to erect a power house at Ashland, Ohio.

The Philadelphia & Reading Railway Company is in the market for a water-softening system for the terminal power house.

The Empire Last Company, Rochester, N. Y., has started the erection of a new plant at Palmer and Breck streets to cost $100,000.

A new six-story factory will be built at 940 Bodine street, Philadelphia, Penn., for Burk Brothers, manufacturers of glazed kid.

The Standard Furniture Company, Herkimer, N. Y., is planning an addition to its factory. New building will be six stories high.

The Albany Chemical Company's plant on Van Rensselaer island, Albany, N. Y., which was recently destroyed by fire, will be rebuilt.

A six-story factory will be built at 235 North Third street, Philadelphia, Penn., for H. O. Wilbur & Son, cocoa and chocolate manufacturers.

The plant of the Maddox Textile Company, of Milford Center, Ohio, was completely destroyed by fire. Loss, $125,000. Will be rebuilt at once.

The Clark Textile Company, of Saratoga Springs, N. Y., is contemplating the establishment of a branch manufactory at Mechanicville, N. Y.

The Volney Paper Company's plant, at Fulton, N. Y., which was destroyed by fire recently with a loss of $75,000, will be immediately rebuilt.

Illinois Vinegar Manufacturing Company, 2143-55 West Fifty-First place, Chicago, Ill., will build a new brick engine room and put in new machinery.

The Manhattan Electrical Supply Company, Ravenna, Ohio, manufacturing electrical supplies and dry batteries, is making an addition to its factory.

The Statler Hotel Company, Cleveland, O., has taken out a permit for $1,000,000 Statler hotel, will require power, electrical and refrigeration plants.

The plant of the Mooresville (Ind.) Water, Light, Heat and Power Company was partially wrecked by a flywheel explosion and much machinery damaged.

The Eagle Woodenware Manufacturing Company, Hamilton, Ohio, has awarded contracts for a new plant and work of construction will be begun at once.

The Piano Player Manufacturing Company, Cincinnati, Ohio, has been incorporated with $50,000 capital by Otto Kreutz, J. J. McCourt, C. J. Fitzgerald, etc.

The Olean Electric Light and Power Company is preparing plans for a new power plant at Ceres, N. Y., with high-tension transmission line to Olean, N. Y.

The Luckow Company, Franklin, Ind., has been incorporated with a capital of $100,000 to operate grain elevators and mills by William, W. W. and C. Luckow.

The molding plant of D. H. Fritts & Co., 114 North Wood street, Chicago, Ill., was damaged by fire. Loss to machinery and stock, $2000. Will be rebuilt.

The plant of the American Smelting and Refining Company, on East Ninety Fourth street, Chicago, Ill., was partly destroyed by fire. Will be immediately rebuilt.

International Sign Company, Cleveland, Ohio, has been organized to manufacture all kinds of signs by M. W. Kastriner, E. Brunst, J. M. Aronwitz, etc. Capital, $50,000.

The Kuhner Packing Company, Muncie, Ind., has been incorporated with a capital of $30,000 by Henry C., E. S. and Frank K. Kuhner to do a meat-packing business.

The plant of the Setter Brothers Company, of Cattaraugus, N. Y., manufacturer of veneer and engraving board, was badly damaged by fire. Loss, $50,000. Will be rebuilt.

Plans are being prepared by architects Harpster and Bliss, of Akron, Ohio, for a $250,000 rubber plant to be erected at Canton, Ohio, for the Knight Rubber and Tire Company.

The Bruce Veneer Company, Portsmouth, Ohio, has been organized with $25,000 capital to do all kinds of veneering and manufacture furniture by John T. Bruce, C. O. Bruce, E. H. Nave, etc.

The Ratsch Throwing Company, Paterson, N. J., has been incorporated with $10,000 capital to manufacture silk and other textiles. Incorporators, S. J. Ratsch, E. B. Ratsch, J. A. Delaney.

The Cleveland Knitting Mills Company, Cleveland, Ohio, has been organized with $100,000 capital to manufacture all kinds of woven articles by Herman H. Neuman, Louis Neuman, Jerome N. Halle, etc.

Power-plant equipment will be required for the 21-story office building to be erected for the Continental and Commercial National bank, at Chicago. Plans are being prepared by D. H. Burnham & Co., Chicago.

The Iowa Auto Tire Filler Company, Des Moines, Ia., has been incorporated with $100,000 capital to manufacture tires for motor cars. Incorporators, Thos. W. McNear, Thos. W. McNear, Jr., W. A. Graham, etc.

The National Brick and Sand Company, Cleveland, Ohio, has been formed with a capital of $25,000 to manufacture brick, tile and clay products by George W. Haskins, Joseph G. Russell, George H. Eichelberger, etc.

It is expected that the Groveville mills, at Beacon, N. Y., which were closed in 1902, following the death of their owner, will be opened by January 1 by the Loeb-Schoenfeld Company, which is establishing a $2,000,000 lace manufactory.

The Ohio Light and Power Company, a newly organized corporation, has taken over the property on the Tiffin Electric Company, of Tiffin, Ohio, and will issue bonds to the sum of $1,500,000 to make many improvements and extensions.

The Federal Heating Company, a Delaware corporation recently organized with $8,200,000 capital to take over the Peck-Williamson Company, and other heating and ventilating interests, will expend a large sum in improving the Peck-Williamson plant, at Oakley, Cincinnati, Ohio. A. W. Williamson, president, Cincinnati, Ohio.

W. M. Bleeker and W. A. Bentley, of Akron, Ohio, and M. G. O'Brien, of Mansfield, Ohio, have selected a site at South Bend, Ind., and will erect a four-story plant costing $25,000, for the manufacture of automobile tires. The new company is soon to be incorporated as the South Bend Tire and Rubber Company, and will employ 150 men at first and 600 within a year.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids August 1, for chain blocks, emery cloth, twist drills, hardware, steel rivets, machine screws, wood screws, machinists' sets, hand taps (schedule 3775), naval round brass, sheet brass, medium plate steel (schedule 3776), plate bronze, bar steel, medium plate steel (schedule 3774).

SOUTHERN STATES

The Chattanooga (Tenn.) Railways Company is erecting a new power house.

Kentwood, La., is contemplating issuing $50,000 bonds for waterworks system.

The plant of the Augusta (Ga.) Veneer Company, recently burned, is to be rebuilt at once.

The plant of the New Blue Grass Canning Company, Owensboro, Ky., was destroyed by

fire. Loss, about $35,000. Plant will be rebuilt.

The Elberton (Ga.) Planing mills, owned by H. B. Swearingen, are being rebuilt. All machinery to be installed will be of the latest type.

Plans have been completed by P. O. Keilholtz, of Baltimore, Md., for a new 35,000-horsepower plant to be erected at Security, by the Western Maryland Power Company.

The Sisson Marble Company, Baltimore, Md., has been incorporated to take over the business of Hugh Sisson & Sons. Plant will be enlarged and additional machinery installed.

The Citizens Electric Company, Charleston, W. Va., has been incorporated to manufacture electricity for light and power. Capital, $25,000. Incorporators, Thos. C. Bowling, G. G. Moore, G. E. Hughes, etc.

Black Diamond Products Company, Fairmont, W. Va., has been organized to manufacture boiler compounds and chemicals. Capital, $100,000. Incorporators, Grover C. Bitner, C. W. Mundgen, J. G. Lake.

The Ridgeley & Miller Avenue Railroad Company, Ridgeley, W. Va., has been organized to construct and operate a street railway. Capital, $25,000. Incorporators, John L. Miller, James T. Vandegrift, A. Ridgeley, etc.

The Parsons Canning and Manufacturing Company, Parsons, W. Va., has been incorporated with $5000 capital to operate canning factory and woodworking establishment. Incorporators, John F. Repair, W. J. Corrocks, J. E. Catherman, etc.

WEST OF THE MISSISSIPPI

George Johnson, of Arlington, S. D., will install an electric-lighting system.

The electric-light plant, at Van Horne, Iowa, was burned. Loss, $14,000.

The Stockton (Cal.) Creamery Company is having plans prepared for a new plant.

The Huntington Beach (Cal.) Water Company will install a new pumping plant.

The city of Centralia, Wash., contemplates the installation of a waterworks system.

Chas. Masin, of Loup City, Neb., will erect a bottling works for Chrystal Bottling Company.

The Todd County Creamery Association, at Long Prairie, Minn., will erect a two-story plant.

The city of Shelton, Wash., has voted bonds for $15,000 for the installation of a sewer system.

The Forest City (Iowa) Creamery Association has secured a site and will erect a factory.

The shingle kiln of W. R. Burke, Anacortes, Wash., was destroyed by fire. Loss, $14,000.

The Empire (Wash.) Salmon Cannery will install new canning machinery, and increase its capacity.

J. W. McAfee, of Topeka, Kan., is agitating the construction of a woolen mill at a cost of $75,000.

The planing mill of the Western Pine Lumber Company, Klickitat, Wash., was totally destroyed by fire.

The city of Newton, Iowa, will install a 250-horsepower water-tube boiler in the municipal light plant.

The Seattle (Wash.) Brewing and Malting Company is having plans prepared for a new cold-storage plant.

The Covina (Cal.) Irrigating Company has had plans prepared for a new power house to be erected at Irwindale.

The St. Louis (Mo.) Independent Packing Company will erect a three-story addition to its refrigerating building.

The Worth (Cal.) District Association will build a new fruit-packing plant. Modern equipment will be installed.

The Pacific Gas and Electric Company, San Francisco, Cal., will increase the capacity of its gas works at Sacramento.

The Pacific Milling Company (grain), San Francisco, Cal., has taken out a permit to erect an addition to its plant.

The Pavlak Mining Company, Jarbidge, Nev., is planning for the erection of a 250-horsepower hydroelectric plant.

The Castle Valley Coal Company, near Price, Utah, plans to install new coke ovens and other by-product equipment.

The H. J. Heinz Company, of Pittsburg, Penn., is arranging to establish a branch pickle plant in St. Joseph, Mo.

Robert Weiss, Upland, Cal., is planning for the establishment of a new laundry plant. The plant will be fully equipped.

The Houlton (Ore.) Commercial Club is interested in a plan to establish a large fruit-evaporating plant in this section.

The Pacific Power and Light Company, Portland, Ore., will increase the capacity of its power plant at Prosser, Wash.

The Capital Box Company, Sacramento, Cal., whose plant recently burned, has taken out a permit to erect a new plant.

The Barr Clay Products Company, S. L. Davidson, secretary, Minneapolis, Minn., will erect a plant at Wanamingo, Minn.

The Alaska Coast Fish Company (T. A. Tubbs), Seward, Alaska, contemplates the erection of a new fish-canning plant.

The Brown Paper Company, at Fort Madison, Iowa, is erecting an addition and will make other improvements to its plant.

The Port Orford (Ore.) Land and Development Company is rebuilding its planing and shingle mill, recently destroyed by fire.

The Grays Harbor Commercial Company's box factory, at Cosmopolis, Wash., was burned. Will be rebuilt. Loss, $30,000.

The Consumers Power Company, of St. Paul, Minn., will spend $10,000,000 in improving its several power plants in the State.

The Coos Bay Home Telephone Company, Marshfield, Ore., is planning for improvements and extensions in its plant and system.

The Pacific Power and Light Company, Portland, Ore., is planning to increase the capacity of its power plant at Hood River, Ore.

The contract for the construction of a power plant at Mandan, N. D., to cost $74,000, was let to G. W. Haggart, Fargo, N. D.

The Corona (Cal.) Foothill Lemon Company, recently incorporated, is planning for the erection of a 250-horsepower pumping plant.

The lumber and shingle mill of the Clarke-Lloyd Lumber and Shingle Company, Sedro-Woolley, Wash., was destroyed by fire. Loss, $30,000.

The Portland (Ore.) Railway, Light and Power Company will make improvements in its substation on First street to cost about $10,000.

The lumber-mill plant of the Chehalis River Lumber and Shingle Company, near Centralia, Wash., was destroyed by fire. Estimated loss, $75,000.

The Stewart Packing Company, Porterville, Cal., will build an addition to its lemon-packing plant. Modern equipment will be installed.

The United Fishermen's Coöperative Packing Company, Astoria, Ore., contemplates the erection of a fish-canning plant at South Bend, Wash.

Power-plant equipment will be required in the new hotel building to be erected by the Dallas (Tex.) Hotel Association. Estimated cost, $650,000.

The lumber-mill plant of the Holland-Cook Manufacturing Company, Fern Hill, near Tacoma, Wash., was totally destroyed by fire. Loss, $50,000.

The Spring Valley Water Company, San Francisco, Cal., is planning to build a new pumping plant at Lake Merced. Plans have been prepared.

The Gywnne Lumber Company, Culdesac, Idaho, is contemplating the erection of a new sawmill plant of 50,000 feet capacity, near Enterprise, Ore.

The sawmill plant of J. H. Chambers Lumber Company, Latham, Ore., recently destroyed by fire, will be rebuilt, and the capacity greatly increased.

The orange-packing plant of the Arlington Heights Fruit Company, Riverside, Cal., was partially destroyed by fire. Loss to plant and machinery, $18,000.

The San Francisco (Cal.) Gas and Electric Company is having plans prepared for a new power plant at Sacramento. Estimated cost of building, $70,000.

The city of Lindsay, Cal., has voted bonds for $75,000 for the installation of a sewer system, and for $55,000 for the construction of a waterworks plant.

The Los Angeles (Cal.) Paper Box factory, Clarence street, has taken out a permit to build an addition to its plant. T. J. Barker is head of this company.

One of the boiler houses of the Fairfield (Cal.) Waterworks was destroyed by fire. The plant will be rebuilt. Henry Goosen is the head of this property.

The box factory of the Grays Harbor Commercial Company, Cosmopolis, Wash., was destroyed by fire. Loss, $40,000. The plant will be immediately rebuilt.

The Canadian Pacific Northwest Fisheries Company (Captain Bolcom), South Bend, Wash., is planning to install a new cold-storage plant for fish products.

A. A. Bartow, Sylvan, Wash., president, the Bay Island Advancement League, is planning for the erection of a large fruit-canning plant in the vicinity of Tacoma.

The Tumwater Light and Power Company, Leavenworth, Wash., is planning to install a lighting and telephone system at Peshastin. A franchise has been granted.

The Pelican Bay Lumber Company, Klamath Falls, Ore., has broken ground for a large lumber-mill plant at Shippington. H. D. Mortensen, president of company.

The San Joaquin Light and Power Company, Fresno, Cal., has commenced the erection of a new substation at Clovis. Another station is to be erected at Lemoore.

The Northern Idaho & Montana Power Company is planning for the erection of a new power plant, near Kalispell, Mont. H. M. Byllesby & Co., Chicago, is interested.

The city of Seattle, Wash., is planning for the installation of a municipal telephone system. City engineer R. H. Thomson has been instructed to prepare estimates of cost.

The Nehalem Valley Telephone Company, Astoria, Ore., has been incorporated by J. C. Pope and J. Jamison, and is planning to install a plant and system in this section.

The Pacific States Telephone and Telegraph Company, Moscow, Ida., is planning to install a new plant and system at Palouse, Wash. About $18,000 will be expended.

The Willits (Cal.) & Laytonville Telephone Company is planning to make improvements and extensions in its system. A franchise has been granted for additional territory.

The Pacific Gas and Electric Company, San Francisco, Cal., has acquired a site at Stockton, and is planning for the erection of a new substation for its waterworks system.

W. D. Newerf, Los Angeles, Cal., has organized a company which is planning to erect a plant for the manufacture of automobile tires. The factory will be fully equipped.

The United States Government, it is said, is planning for the erection of a large power plant at Lahonton Dam, near Fallon, Nev., for operation on the Truckee-Carson project.

N. W. Tallant, the Port Kenyon (Cal.) cannery, is planning for the erection of a new salmon-canning plant on the Eel river, near Loleta, Cal. A site has been selected.

A refrigerating plant will be installed in the new dairy buildings to be erected by M. Heischhacker, Woodside, near Redwood City, Cal. Greene & Greene, architects, Pasadena, Cal.

The city of Klamath Falls, Ore., is contemplating the installation of a new waterworks system. L. C. Kelsey, Portland, has been engaged as engineer for preliminary plans.

The Stewart Fruit Company, Los Angeles, Cal., has been incorporated with a capital of $100,000 to engage in the fruit-packing industry. Oliver Ellsworth, Frank Otis, incorporators.

The San Antonio Ice Company, Ontario, Cal., has been incorporated, and is planning for operations in this section. The Pomona (Cal.) Valley Ice Company will control this organization.

The Delano-Linn's Valley Telephone Company, Bakersfield, Cal., has been incorporated by Benj. Thomas and J. C. Rutledge, and plans to install a plant and system in this district.

The Los Angeles (Cal.) Mill and Lumber Company will establish a new lumber-mill plant at Long Beach. The plant will be fully equipped. Frank W. Rietz is president of this company.

The West Ontario Water Company, Ontario, Cal., has been incorporated by R. B. Campbell and C. H. Ford. The company plans to install new pumping plants for irrigation work.

Power-plant equipment will be required in the new eight-story office building to be erected by W. Parsons, etc., Seattle, Wash. Estimated cost, $400,000. Howell & Stokes, architects, Seattle.

The Mount Shasta Power Company, Redding, Cal., has commenced construction on its power tunnel, which is to be used in connection with its proposed power plant, near Big Bend, on the Pitt river.

Balfour-Guthrie & Co., Bellingham, Wash., interested in the Olympic Portland Cement Company, is planning for the erection of a flour-milling plant at Portland, Ore. About $50,000 will be expended.

Power-plant equipment will be required in the new auditorium building to be erected by Emil E. Kahn and associates, San Francisco, Cal. About $150,000 will be expended. J. B. Randell, architect, San Francisco.

The State Milling and Elevator Company, Cache Junction, Utah, has been incorporated with a capital stock of $50,000; the company will operate a grain-milling plant. Edward Dahle is president of company.

The Thompson-Snow Amusement Company, Los Angeles, Cal. (Herbert C. Snow, president), will install an artificial ice-skating rink and refrigerating plant of 500 tons daily capacity at Luna Park (Los Angeles).

The Pacific Coast Codfish Company (E. Jansen), Seattle, Wash., has commenced construction of its new codfish-packing plant, at Paulsbo, Puget Sound. The plant will be fully equipped with necessary machinery.

H. A. Smith, Tucson, Ariz., is at the head of a company which plans for the erection of a large power plant at Noria, Sonora, Mexico. An irrigation system will also be installed. A large flour-milling plant is contemplated.

Power-plant equipment will be required in the new temple building to be erected by the Allied Masons, Seattle, Wash. Estimated cost, $200,000. D. E. Frederick and F. C. Drew have been elected on a building committee.

The Board of Supervisors, Los Angeles, Cal., has fixed August 31 as the date for bids to close on two engine-generator sets for the Hall of Records. Hudson & Munsell, architects, Los Angeles. H. J. Lelande, county clerk.

The Hood River Orchard Land Company, Ortley, near Mosier, Ore., is planning to install an aërial tramway, about one mile long. Wilbur F. Purdy, the Engineering and Construction Company, Portland, Ore., is preparing plans.

Power-plant equipment will be required in the new fraternal home buildings to be erected by the Grand Lodge of Odd Fellows, at Saratoga, Cal. Estimated cost, $250,000. Ralph W. Hart, architect, San Francisco, is preparing plans.

State architect W. C. Knighton, Salem, Ore., has completed plans for the new insane hospital to be erected at Pendleton. A power plant, comprising boilers, generating machinery, pumps, etc., and a refrigerating and cold-storage plant will be installed.

The California-Nevada Power Company, Goldfield, Nev., is planning to install a transmission system and new power plants in San Bernardino and Riverside counties, Cal. About $300,000 will be expended. Delos A. Chappell is president of this company.

The Standard Oil Company has appropriated $750,000 for the erection of a new asphalt-manufacturing plant, at Point Richmond, Cal. The company has also broken ground on its property, near Fullerton, Cal., for the erection of a large power house.

The San Pedro (Cal.) Marine Construction Company has been organized by H. C. Bowers, Los Angeles. The company has acquired the marine and boat-building plant of the Fulton Marine Construction Company, at San Pedro. The capacity of the plant will be increased and new machinery installed.

The Coalinga (Cal.) Water and Electric Company has filed articles of incorporation with a capital stock of $2,000,000, and headquarters at Los Angeles, Cal. W. G. Kerckhoff, A. C. Balch and Kaspare Cohn, all of Los Angeles, and connected with the Pacific Light and Power Company, are incorporators.

CANADA

Midlad, Ot., will install a new sewage system.

Eburne, B. C., will install a complete new sewage system.

Prince Albert, Sask., will equip a big new power station.

Edmonton, Alberta, will equip a big new pumping station.

Burnaby, B. C., will install a complete waterworks system.

Dresden, Ont., will install a new waterworks pumping plant.

Hamilton, Ont., will spend $500,000 on new power and light equipment.

The Zimmerman Knitting Company will double its factory at Hamilton, Ont.

The Western Canada Sawmills Company, of Saskatoon, Sask., is extending its plant.

A. L. McCulloch, Nelson, B. C., will equip a big new power plant on the Kootenay river.

The West Lorne Lumber Company, of West Lorne, Ont., will locate big new mills there.

Orillia, Ont., will spend $80,000 on machinery for a new power-development plant.

Brandon, Man., will equip a new street-railway system complete with power house, etc.

The George C. Salt Lumber Company, of Vancouver, B. C., will locate big new mills there.

The Yahk Lumber Company, of Yahk, East Kootenay, B. C., will locate big new mills there.

The Medicine Hat Milling Company will locate a big new plant at Medicine Hat, Alberta.

Medicine Hat, Alberta, will buy new pumps, boilers, etc., for extensions to its waterworks.

The Fraser Valley Tile and Cement Company will locate a very large new plant at Ladner, B. C.

Mayor Beattie is in charge of a big new paving plant that will be built for the city of London, Ont.

The Canada Chemical Company will install a big water-pumping plant of its own at Parry sound, Ont.

F. W. Farncombe, London, Ont., is calling for tenders for two half-million gallon steam pumps, boilers, etc., for waterworks.

John F. Lennox, of Toronto, is head of a company which will locate a big new brick-manufacturing plant at Willcox lake.

Port Arthur, Ont., will spend $75,000 for waterworks extensions including new machinery, and $20,000 on street-railway extensions.

The Columbia River Lumber Company, head office, 18 Hastings street, Vancouver, B. C., will locate several new plants in British Columbia.

MINING

The Whitman mine, near Pearl, Ida., will build a new milling plant.

The Copper Hill mine, La Plata, Colo., will build a new smelting plant.

Forest Goody, Osceola, Nev., contemplates the erection of a stamp mill on his properties.

The Butte (Mont.) Central Copper Company contemplates the erection of a concentrating plant.

The Daly-Judge Company, Park City district, Utah, will increase the capacity of its milling plant.

The Planet mine, near Phœnix, Ariz., contemplates the erection of a reduction plant in the near future.

R. H. Hickey, Ray, Ariz., is at the head of a project to build a custom-smelting plant near Paradise, Ariz.

The Cyclopic mines, Gold Basin district, near Kingman, Ariz., contemplate the erection of a stamp mill.

The Bard Creek Mining Company, Georgetown, Colo., contemplates the erection of a new concentrating plant.

The Kennison Atkin mine, George's cañon, near Manhattan, Nev., is contemplating the erection of a milling plant.

L. M. Sukeforth, Upper Greenhorn district, near North Bloomfield, Cal., will increase the capacity of his milling plant.

The West Coast Copper Mines Company, Tecolote, Sonora, Mex., is planning for the erection of a reduction plant.

The Golden State mine, Grass Valley district, Cal., will install new engine equipment and other operating machinery.

The Oregon Strong Ledge Mining Company, near Murphy, Ore., has broken ground for the erection of a 25-ton milling plant.

The Silver-Lead Mining Company, Cœur d'Alene district, Ida., will build an addition to its 400-ton concentrating mill.

The Ely (Nev.) Revenue Mining Company contemplates the erection of a new milling plant. About $75,000 will be expended.

The Black River Copper Company, near Turkey station, Ariz., is planning to install new hoisting and operating machinery.

The Rambler-Cariboo mine, McGuigan, B. C., is planning for the erection of a new stamp mill, replacing that recently destroyed.

The Balaklala Copper Company, near Kimberly, Shasta county, Cal., is planning for the erection of a new smelting plant in Neveda.

The Carbonate Hill Mining Company, Wallace, Ida., contemplates the installation of a concentrating plant in the near future.

The Detroit Copper Company, Morenci, Ariz., will increase the capacity of its reduction plant. New equipment will be installed.

The Williams-Gentzler mine, near Valdez, Alaska, is planning for the erection of a stamp mill; an aërial tramway is also contemplated.

The Cerro Colorado Mining Company, operating at Cerro Colorado, near Batopilas, Chihuahua, Mex., is planning for the erection of a cyanide plant.

The Sunset Mining and Smelting Company, operating in the North Hell cañon district, N. M., will install new boilers, engines, and other operating machinery.

The Western Asset and Development Company, Contact, Nev. (Delano mines), is planning for the erection of a power plant; a smelting plant will also be installed.

The Utah-Nevada Mining Company, operating the Alta mine, near Kerby, Ore., has commenced the erection of a 40-stamp mill, and sawmill plant on its property. Both plants will be fully equipped.

Business Items

The Bullard Machine Tool Company has appointed Harry Ellis, Jr., 1138 Mutual building, Richmond, Va., representative for the territory surrounding Richmond.

The O. K. Clutch and Machinery Company, Manheim, Penn., has moved to its new factory, at Columbia, Penn., where it will have increased facilities for manufacturing purposes.

The Standard Tool Company, of Cleveland, Ohio, announces the opening of a western branch at 552 West Washington boulevard, Chicago, Ill., where a complete stock of the company's various products will be carried for immediate delivery.

A. de Gennes, general representative in France of the Sullivan Machinery Company, Chicago, Ill., has retired from business. Hart O. Berg, 20 Rue de Champes Elysees, Paris, will in the future be in charge of this company's business in France, under the direction of the European branch office, at London, 814 Salisbury house, H. T. Walsh, manager.

Forthcoming Meetings

National Society for the Promotion of Industrial Education: fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Working drawings made from sketches or specifications; detailing and designing done; sheet metal layouts made; rates reasonable. Box 26, AMERICAN MACHINIST.

General machine and tool and die work of every description solicited at hour rate or contract estimates furnished. James T. Carroll, 526 Hunter's Point Ave., Long Island City, N. Y.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Wanted, by a manufacturer's agent covering Pacific Coast, machinery, specialties, or supplies on commission basis; can furnish best of references, J. T. S., 409 Pacific Bldg., Seattle, Washington.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Patents—A able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Auto cases and tubes first quality guaranteed—28x3 $10.30, tube $2.75; 30x3 $11.30, tube $2.85; 30x3½ $15.45, tube $3.75; 32x3½ $18.70, tube $4.25; 34x4 $27.45, tube $5.75. Send for list of all sizes. I ship, allow examination on receipt of 10 per cent. amount of order. The largest tire dealer in the central States. W. Vanderpool, Springfield, O.

Wanted—Party or parties to buy outright or to take a license on the basic patents on the only automatic continuous solids and filter press in existence, pressing between cloths, loading and unloading automatically; pressing can be regulated to any extent with or without hydraulic or screws, or it can be run as an ordinary press at the same time doing away with the trouble of taking apart the machine to run over the cakes; manufacturers will require no special machinery; the press can be seen in operation and a thorough investigation made of its many possibilities. K. S Berrigan, sole owner, 136 North Centre street, Orange, N. J.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Assistant to head of premium department, setting time limits in a large electrical factory in Canada; applicants please state experience and salary required. Apply Canadian General Electric Co., Peterboro, Canada.

Chief draftsman for mechanical department of large corporation building a general line of cranes, coal and ore handling machinery, etc.; must be a man of large experience and have good knowledge of structural work; position permanent at good salary; location, northeast. Box 61, AMERICAN MACHINIST.

IOWA

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, AM. MA.

MASSACHUSETTS

Wanted—Energetic, technical man, with executive ability, to take charge of inspection department for incoming goods; must have technical education and actual shop experience; must be familiar with testing and inspecting of metals, insulating materials and machine parts; experience in purchasing and correspondence desired; state age, references, experience in detail, places and periods of employment and salary expected. Address "Inspector," Box B, Springfield, Mass.

MICHIGAN

Foreman wanted for light hardware manufacturing in department of stamping and automatic screw machines; give age, experience, references and wages required. Box 96, AM. M.

NEW JERSEY

Tool designers wanted. Apply, stating age, experience and salary wanted to Crocker-Wheeler Company, Ampere, N. J.

We will have openings for machinists and toolmakers during July; mail your application, giving references and wage at last place. Crane Motor Car Company, 96 West Seventh street, Bayonne, N. J.

Chief inspector wanted in large factory manufacturing a high class product of many small parts; a capable man required with high appreciation of accuracy; state age, salary and full qualifications. Box 89, AM. MA.

NEW YORK

Wanted—Two first class operators of horizontal boring machines; state age, experience and references; applications considered confidential. Box 23, AMERICAN MACHINIST.

We want a machinery salesman who has had successful experience in Europe, to visit the trade and do missionary work in England; state salary, experience and references. Box 79, AMERICAN MACHINIST.

Wanted—Superintendent for automobile factory; one who has had experience in high class work only will be considered; must be a good handler of men, and a good systematizer. Apply, stating experience, Box 65, AMERICAN MACHINIST.

Wanted—Machinists wanted. lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Salesman for line of pliers and some high grade specialties to visit jobbing and retail trade east and west; must also visit machine shops to introduce specialties; state age, experience, territory covered, salary desired and references. "K. F.," AMERICAN MACHINIST.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

NORTH CAROLINA

Wanted—German-American mechanic, who has some knowledge of mechanical drawing, as foreman of machine shop in small town; state experience, present position, age and salary expected. S. Parker, Pine Town, N. C.

OHIO

One planer, one lathe hand and Jones & Lamson operator, who is familiar with cast iron operation. Box 77, AMER. MACHINIST.

Wanted—An experienced operator on automatic screw machine; must be capable of estimating on work; also designing the tools for same. Box 97, AMERICAN MACHINIST.

Foreman for small shop in Ohio building medium weight automatic machinery; must have experience in this class of work and be particularly efficient in managing fitters; salary $150 per month; give full details, experience, reference, etc., in first letter. Box 81, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Wanted—General superintendent to take charge of a sheet metal stove shop employing 1000 men; must be thoroughly familiar with sheet metal work, factory management and equipment; he must be strictly sober, efficient and have good constructive ability, and be able to furnish first class references as to character, experience and ability; only those who can fully qualify need apply. Address "Supt.," Box 80, AMERICAN MACHINIST.

PENNSYLVANIA

Superintendent for drop forge plant; good salary and permanent position for first class man; give full particulars. Box 98, AM. MA.

Wanted—Practical machinist, experienced in rate setting and time study work; must be familiar with steam engine or pump work. Box 48, AMERICAN MACHINIST.

Wanted—Instructors in mechanical engineering, in electrical engineering and in mechanical drawing at an eastern institution; applicants must be graduates of technical schools, preferably with one or two years' practical experience. Box 78, AMER. MACH.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wanted—General superintendent for manufacturing plant established nearly thirty years, whose product is standard and comprises the largest line of its kind in the world; light and medium manufacturing, interchangeable parts and where the production of volume, decreased costs and the proper layout of machinery and work are essential; a practical experienced man to be in charge of factory, production and the manufacturing generally; only experienced men of thoroughly good character and habits will be considered and who are capable of handling men, introducing improved methods, and thoroughly familiar with cost systems, stock systems and modern shop practice; state references, experience, past and present employment, age and salary expected in first letter. Box 76, AMERICAN MACHINIST.

VERMONT

Salesmen—We want several salesmen to sell Gridley automatics; applicants should give full particulars as to experience and state salary expected. Box 66, AM. MACH.

VIRGINIA

Wanted—A first class draftsman, one having experience in elevator designing and layouts preferred; state experience, age and salary expected. Westbrook Elevator Company, Danville, Va.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address, Sumner Iron Works, Everett, Wash.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Autos—First class operator (B. & S.), used to designing cams, etc., desires change; fully competent to take charge of department; good references. Box 92, AMERICAN MACHINIST.

Young man (26), well up on automatic and hand screw machine work, desires position as traveling demonstrator, operator, or salesman; good references. Box 93, AMER. MACHINIST.

ILLINOIS

Position as superintendent, by expert tool designing draftsman, experienced as draftsman, tool and die maker, and tool room foreman on typewriter and similar work; age 32, married. Box 6, AMERICAN MACHINIST.

I have had well balanced technical and practical experience of 15 years specializing on tools and machinery for the manufacture of machinery and metal products, including automobiles and machine tools, as machinist, chief draftsman, designer and manager; wish responsible position in this line; 32 years old and can furnish references to interested parties. Box 74, AMERICAN MACHINIST.

My fifteen years' experience in shop, foundry and drafting room and office in the manufacture of high grade machinery, with record as a designer, originating and developing new ideas and keeping product uptodate, is available to any manufacturer who is in need of a high grade man, experienced as chief draftsman, mechanical engineer and manager; at present employed. Box 73, AMER. MACH.

MAINE

Manager or superintendent of machine shop, forge or foundry; first class references. Box 996, AMERICAN MACHINIST.

MASSACHUSETTS

Experienced machine tool salesman with extensive acquaintance in the East and Middle West, wants position; can show a splendid record and give best of references. Box 84, AMERICAN MACHINIST.

Hustling, uptodate machine shop superintendent, with 20 years' varied experience, manufacturing special and general machinery, wants position; location not important; best of references. Box 85, AMER. MACHINIST.

NEW JERSEY

Mechanical engineer, with office and shop experience, desires position in Metropolitan district. Address "E.," Box 51, AMER. MACH.

Technical graduate (27), German descent, having broad shop and designing experience, wishes position as foreman, superintendent or engineer with manufacturing plant or office. Box 91, AMERICAN MACHINIST.

NEW YORK

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Machinist, 22, with knowledge of drafting, desires position in machine shop or drawing room. Box 94, AMERICAN MACHINIST.

Toolmaker: fine tools, experimental or model work; qualifications A-1; references A-1. Box 71, AMERICAN MACHINIST.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Executive, practical man, 20 years' experience in manufacture of metal specialties, instruments and machine work; tool expert, supervisory knowledge of sales and office work; economical producer. Box 90, AM. M.

Superintendent, 14 years in charge of manufacturing and building high class automatic machinery and machine tools; good organizer of shop system that will show good profits; New York or New Jersey preferred. Box 83, AMERICAN MACHINIST.

Position as manager of concern doing from $150,000 to $250,000 business per annum; practical, manufacturing and sales experience; technical graduate; would be interested in proposition of nominal salary and share of profits. M. K. F., AMERICAN MACHINIST.

Wanted—Position as general foreman or foreman machinist by Scotchman, 35 years of age, progressive position with plenty of responsibility and work preferred; undoubted mechanical and executive ability; A-1 references; at present employed. Box 87, AM. M.

Manager or general superintendent; can make the price, sell output, improvements permanent, broad lines, individual effort system for help, direct through strong organization, practical experience; no trifling; shop or foundry; now employed. Address "Executive," AMERICAN MACHINIST.

Young man of 22, expert milling machine operator, can work within very close micrometer measurements; understands thoroughly speeds and feeds, the piece work system and is well versed in modern methods for the rapid production of duplicate parts; has had some experience as gang foreman. Address "Hustler," AMERICAN MACHINIST.

Tool and diemaker with 16 years' experience (six years in own experimental and model shop), wishes position with responsibility or permanent position at experimental and model work; practical designer for novelty work, tools for typewriters, adding machines and vending machines; A-1 references. Box 95, AMERICAN MACHINIST.

NORTH CAROLINA

Mechanical engineer, 32, as superintendent or engineering capacity; technical education; four years shop, 10 years drawing room; is open for position. Box 70, AMER. MACH.

OHIO

First class plater, polisher and buffer who has had 20 years' experience and desires to make a change; can furnish good reference. "L. F. K.," AMERICAN MACHINIST.

Chief tool designer or master mechanic desires making a change in the near future and invites correspondence from parties, requiring the services of such a man; specialist in uptodate production methods and cost reduction in making interchangeable machinery. Box 86, AMERICAN MACHINIST.

PENNSYLVANIA

Designing draftsman, from sketches, schemes from conception to detail conclusion; care of interchangeable parts; fine designer original and suggestive; acted as supervising draftsman. Box 82, AMERICAN MACHINIST.

FOR SALE

For Sale—One locomotive boiler of about 50 horsepower, and one marine boiler of about 75 horsepower; both in good condition; we have been using these to heat our entire plant, but as we are making additions which necessitates the use of larger boilers, must dispose of them at once. Simplex Motor Car Co., Mishawaka, Ind.

Machine shop for sale in a manufacturing town in New Jersey; saw tooth roof and steam heated; lathes from 9 inches up to 42 inches; good chance for one or two bright mechanics to invest a few thousand dollars; an excellent opening for automobile shop and foundry along with present business. Box 88, AMERICAN MACHINIST.

For Sale—Outright, or will license to one or more, the basic patents on the only automatic, continuous, solids and filter press in existence, pressing between cloths, loading and unloading automatically; pressure can be regulated to any extent without or with hydraulic or screws, or it can be run as an ordinary press; at the same time doing away with the trouble of taking the machine apart to remove the cakes; manufacturers will require no special machinery; the press can be seen in operation and a thorough investigation can be made of its great possibilities. K. S. Berrigan, sole owner, 136 North Centre street, Orange, N. J.

Talks With Our Readers

By The Sales Manager

Arthur Brisbane, whose editorials in the Hearst papers probably reach more people each day than those of any other man, and who gets $50,000 per year for writing them, recently addressed the Advertising Men's League of New York City on "Does Advertising Increase the Cost of Living."

A few of his good remarks follow:

"The cost of living is a thing we cannot nail down. Years ago there was the same kind of talk about it. One of our early presidents said the country was going to the dogs because you could not get a man for less than a hundred and fifty dollars a year."

"If there is any problem of cost of living it's because there has not been enough good advertising."

"In the first place I should say that advertising is to business and the community what speech is to the individual socially."

"Now, before man could talk, if he knew a thing it was impossible to tell another human being about it."

"Imagine the waste of time, money and effort if the five million people in this community could not speak."

"One might know where such and such a thing might be had and could not tell the others, and each one would have to find it out for himself—where it was or where the best was. It would be an absolutely foolish waste of time if they could speak."

"Advertising is business speech."

"There is nothing about advertising except economy, except saving, except reduction of the cost of living."

"Of course, when you talk about advertising, manufacturing or agriculture you don't talk about stupid advertising, manufacturing or agriculture. Farmers that lose money don't count. Advertisers that try to persuade the public to lose money don't count."

"Advertising, of course, is a medium of distribution."

"Take this question about the lack of advertising. Suppose everyone stopped advertising, what would happen? Of course, you would have to talk, you would have to tell people things and very badly."

"Advertising does another thing which should be emphasized. It makes the advertiser give hostages to commercial honor."

"If the manufacturer said 'this value has built these enormous factories, they have cost me millions and there is no insurance on them,' nothing would make him set fire to them. Now, the manufacturer's reputation is uninsured. He spends thousands in building something more solid than a brick building, and when he has built that up, built up that name, you cannot imagine that he would jeopardize that fortune by making his goods inferior."

A manufacturer has to live with and on the reputation of his goods, keep them sold and make them sell others.

That's why only reliable products can be continuously advertised.

That's why buying advertised products is the cheapest quality-insurance you can possibly get.

Some Sewing Machine Shop Methods

By F. A. Stanley*

Features of hand-wheel manufacture and the bevelling of thin steel plates for shuttle-race covers by means of a shaving machine with magazine feed, light profiling apparatus for small parts, special grinding and lapping machines for tension disks and presser feet.

A handy assembling fixture for pressing the heads onto a ball-bearing pitman.

Erecting the sewing-machine stands and testing the completed shuttles.

*Western editor.

We have already illustrated a number of special tools and methods in the plant of the Davis Sewing Machine Company, Dayton, and in the accompanying engravings some further views of machines and operations in this establishment are shown.

Machining Hand Wheels

In the halftone, Fig. 1, two automatic screw machines are represented in operation upon sewing-machine handwheels, which are required in such numbers as to keep a battery of these machines constantly employed. The castings are placed in the open sided magazine which holds about a dozen wheels and from which they pass down one by one to the retaining jaws pivoted under the open end of the magazine. The cast wheel is removed from the jaws at the proper moment by a "transfer" in the turret and placed by this intermediate device into the chuck jaws ready for machining by the turret- and cross-slide tools.

The work is gripped by jaws that pass between the inside of the rim and the hub; and the outside of the wheel as well as the belt groove are thus reached by the tools and finished without interference with the chuck jaws. As the wheels pass out of the jaws they slide down a wooden chute into the pan.

Reaming Handwheels

After the wheels are machined in the bore and on the rims they are nickeled and this process leaves a scale in the hole that is removed by a rapid reaming process carried on under the sensitive drill press in Fig. 2.

The fixture in which the work is held is merely a circular casting upon which the handwheel is dropped and located under the spindle, and a pull of the lever passes the reamer down through the bore in an instant, leaving the surface clean and smooth, so that it will fit properly upon its shaft in the sewing machine.

The engraving shows the handy trucks upon which such parts are moved about the factory and also serves to draw attention to the large quantities in which members of this character are put through the machining operations.

Shaving Cover Slides

Of the two machines in Figs. 3 and 4, the first is used for machining the edges of shuttle-race covers, which are beveled to a given angle and must be smooth and parallel from end to end in order to slide freely in their guides in the bed plate. As the plates are thin a shaving process is entirely feasible for producing the required character of surface and the machine in Fig. 3 accomplishes this work in an efficient manner.

The plate itself will be seen in Fig. 5, with an end view of the shaving machine represented by the sketch at the right, which is merely to show the general principle without accuracy as to detail.

Referring to the general view, Fig. 3, and the sketch, Fig. 5, it will be seen that the steel plates are passed between two sets of cutters which convert the square edges into bevel surfaces of the requisite degree of angularity. There are eight cutters on each side of the machine and the steel plates are passed between them along a channel which not only guides the work but also admits the ends of the shaving tools. These latter are set, looking from the end of the machine, at the same angle as the edges are to be beveled on the work; and they also have a slope or rake, toward the magazine from which the plates are fed, so as to give them a shearing cut.

The Magazine and the Feed

The magazine *A*, Fig. 3, is a vertical receptacle of sufficient hight to hold several dozen plates, and under this chute a slide is reciprocated at a constant, slow rate of speed, by a cam at *E*. The shaft upon which the cam is mounted is actuated by worm wheel and worm at the rear of the machine. The reciprocating slide, after feeding the first blank between the tools, returns for the next and upon the second forward stroke the second blank pushes the first one further forward and this operation repeated, at the eighth stroke causes the first blank to pass out from between the tools and fall into the tray.

The eight pairs of cutters or shaving tools are adjusted by the nurled head screws at *C*, and each pair is set to take a chip of definite proportions so that the

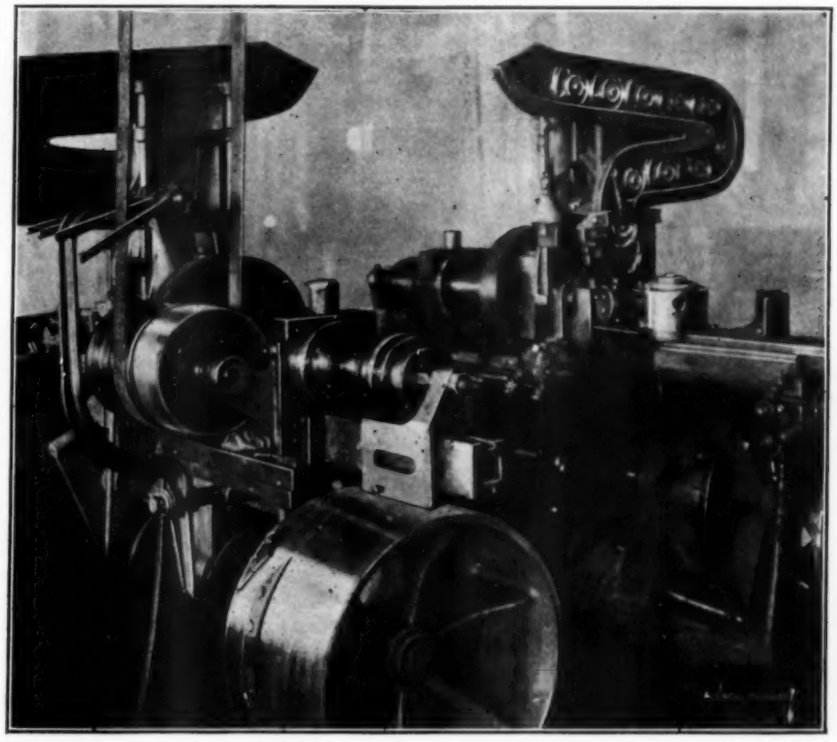


Fig. 1. Finishing Handwheels in Magazine Automatic Machines

work is properly distributed along the series of tools. The tools are secured in their seats by clamps across their tops and the work is so confined in its passage along the guide that there is no opportunity for vibration and for chatter marks on the edges of the plates.

The machine is fitted with an oil pump and lubricant is forced in from the end of the guide bar to flood the work and tools during the shaving operation.

A Small Profiler

The profiler in Fig. 4 is illustrated as a special, light-acting machine designed for machining a variety of work entering into sewing-machine construction. A number of fixtures and forms are used on the machine for various purposes and with one of these fixtures set the profiling process is carried on easily as both the table and head are readily manipulated.

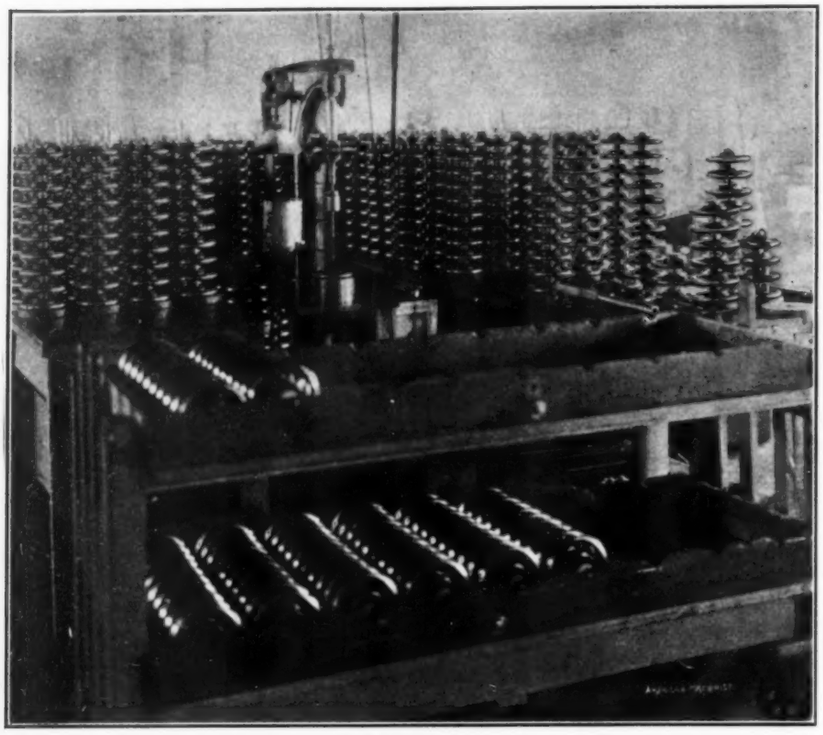


Fig. 2. Reaming Operation in the Handwheel Department

Grinding and Lapping Machines

Grinding processes of different kinds are extensively employed in sewing-machine manufacture, and two machines for finishing parts by abrasive methods are shown in Figs. 6 and 7.

The machine in Fig. 6 was constructed for finishing tension disks and its three spindles carry abrasive disks of three degrees of fineness, so that the work is swung from one to another in the grinding and lapping process. The work is mounted in a chuck on a spindle which is carried in a horizontally swiveling head that may also be rocked in the vertical plane, its counterbalance normally retaining the vertical position until the lever is actuated to tilt the head as required.

With the same lever the head is swung about its vertical pivot to keep the work in contact with one of the disks and then may be rocked opposite the next finer disk and brought to a nicer degree of finish, after which it is tilted still further opposite the finest of the three disks for the completion of the surface finish.

The work spindle is driven by a round belt and is adjusted endwise to maintain the contact between work and disk by pushing the knob at the rear end of the spindle.

Finishing Presser Feet

The machine in Fig. 7 also carries three wheels or disks which are in one straight line, the work being slid past each wheel by means of fixtures on the long table. This machine finishes the ends of presser feet after they are placed upon the presser bar, and during the grinding and polishing performance the bar rests in one of the V-blocks which

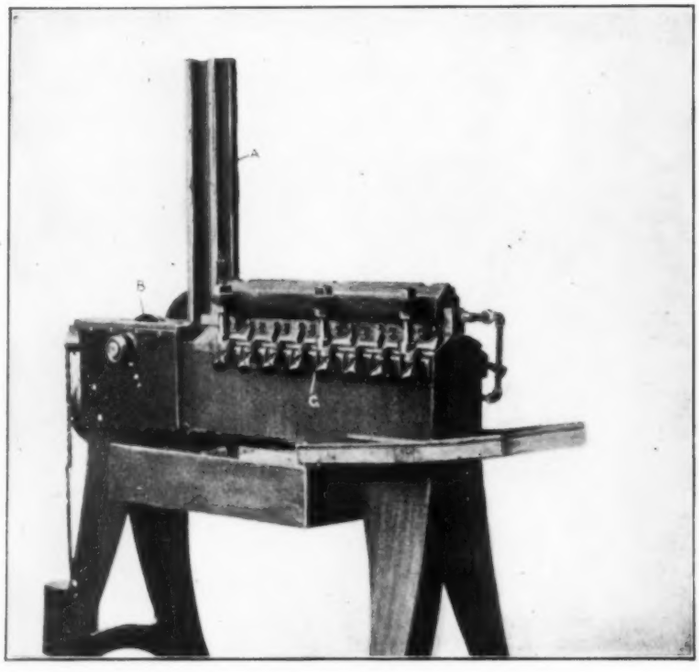


Fig. 3. Machine for Shaving Edges of Race Covers

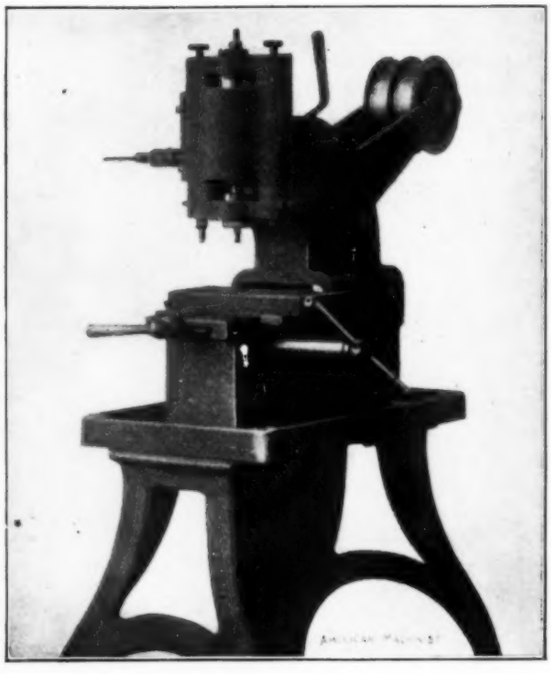


Fig. 4. A Small Profiler

holds it perfectly square with the faces of the disks. Here, as in the previous case, the abrasive wheels are of three grades of fineness and the operator can readily pass the presser bar with its foot from one finishing medium to the next without loss of time.

In the view, one disk is removed to permit the driving pulley at the rear to be shown. The driving belt in this instance passes from the countershaft down under the pulley on the central spindle and under the corresponding pulley on the right-hand spindle. This spindle carries a second pulley which drives the horizontal belt shown leading across to the pulley on the left-hand spindle.

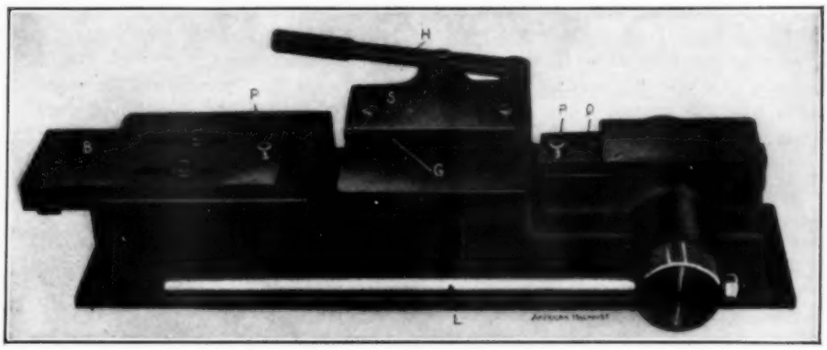


FIG. 8. PITMAN ASSEMBLING FIXTURE

PITMAN ASSEMBLING FIXTURE

In Fig. 8 a fixture is shown for assembling the ball-bearing pitman, which is represented in the sketch, Fig. 9. The ends of this pitman, drilled ready to be pressed on to the rod, are placed over the two pins *P P*, Fig. 8, with the rod resting in the groove *G*, where it is confined against side buckling tendencies by movable jaw *S*, which is controlled by handle *H*. When lever *L* is operated, slide *Q* is forced forward by a pinion and rack, pressing the heads of the pitman firmly onto the rod.

The block *B* is adjustable to accommodate different lengths of rods and when properly set it is clamped against movement under end pressure, by two cap screws passing down through the slots and into the base of the fixture.

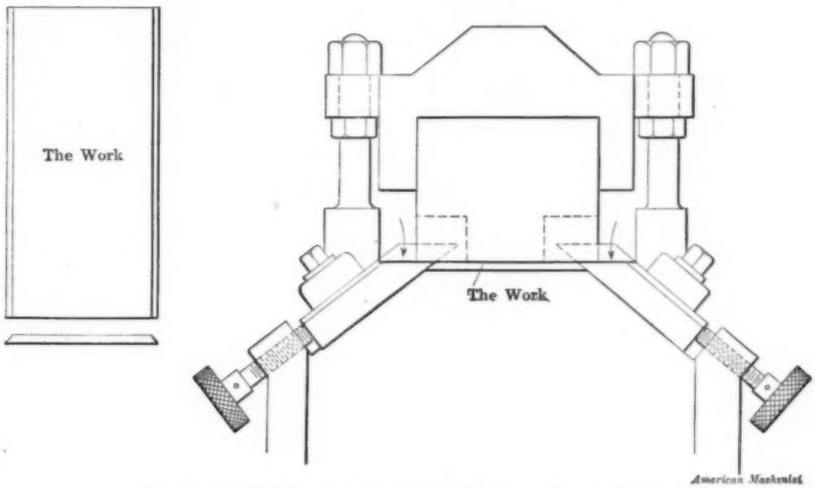


FIG. 5. MACHINE FOR SHAVING EDGES OF RACE COVERS

ERECTING FRAMES

When securing the cast-iron legs to the sewing-machine table, it is desirable that the bottoms of the casters shall all be kept in one plane in order that the machine shall stand firmly on a level floor. So in tightening up the screws by which the metal standards and the wood frame

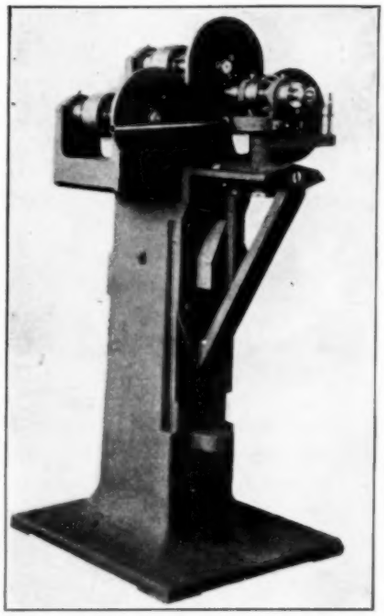


FIG. 6. THREE-DISK MACHINE FOR FINISHING TENSION DISKS

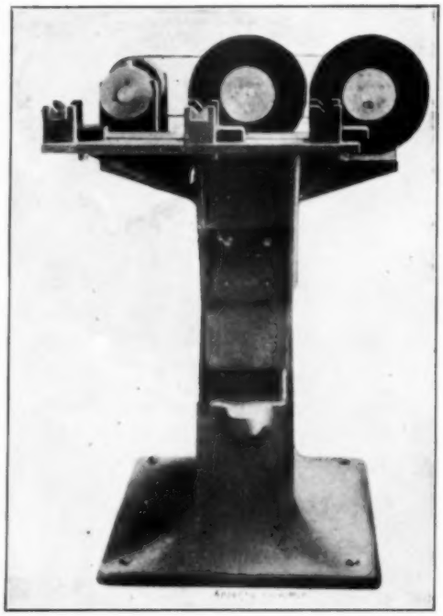


FIG. 7. MACHINE FOR GRINDING AND FINISHING PRESSER FEET

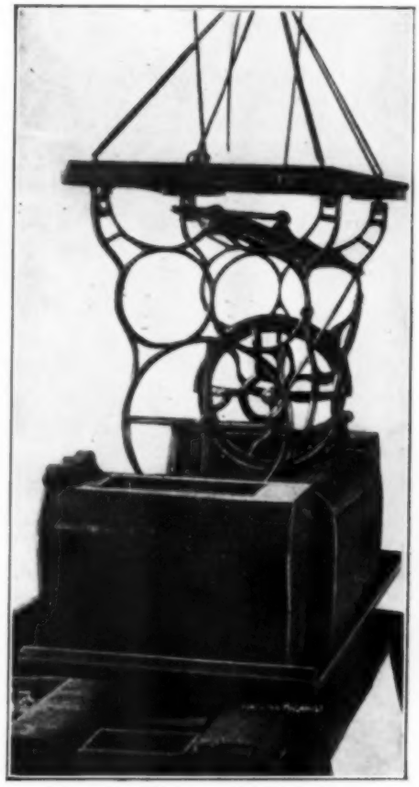


FIG. 10. SUSPENDED TEST PLATE

are joined together the suspended "surface plate" in Fig. 10 is employed to advantage to determine if the bearing faces of the casters are in a common plane. In this operation the stand is, of course, bottom side up.

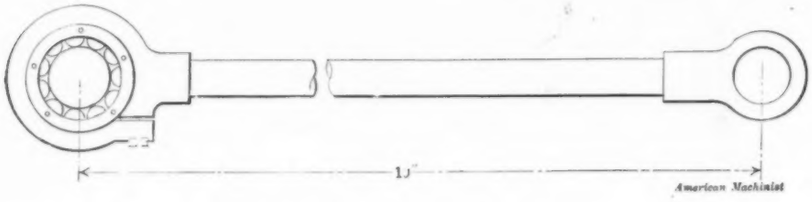


FIG. 9. BALL-BEARING PITMAN

The test plate is a heavy wood frame with metal corners, and is suspended from the corners by a weighted cord passing over a pulley under the ceiling. Generally speaking, when the screws are set up tight the casters will be found to be sufficiently level, or to require but a slight straining up of one or two screws to correct their relation to each other. Where more than this is necessary, however, a thin shim is placed between wood and metal at the required corner and the leveling process proceeded with.

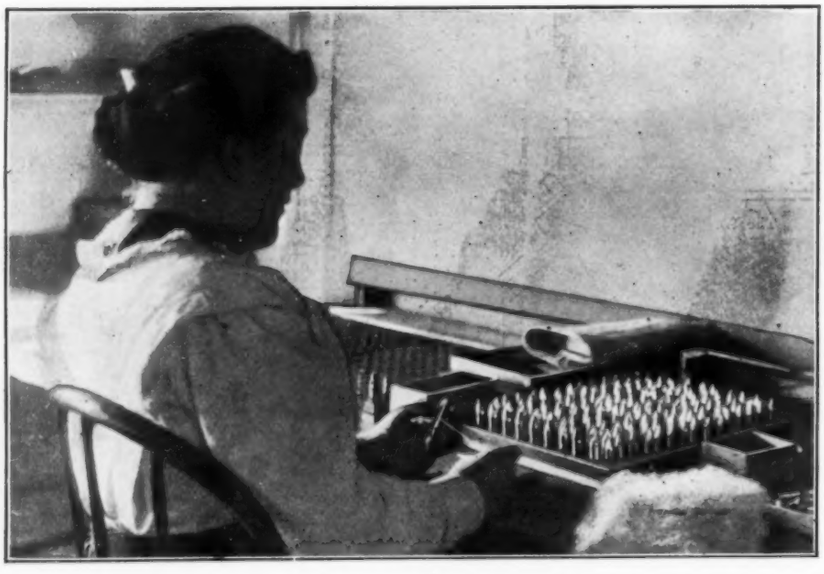


FIG. 11. INSPECTING SHUTTLES

INSPECTION OF SHUTTLES

The view in Fig. 11 indicates the method of testing each and every shuttle after the customary inspection with gages has been attended to. This final inspection process consists in threading the shuttle from its bobbin and pulling the thread along under the shuttle spring with the fingers to determine if the spring is in proper adjustment.

The young woman who tests these shuttles can tell at once from the "feel" of the thread as she quickly pulls it through under the spring, whether the latter is suitably adjusted and, if it is not, a rapid movement with the screw driver applies the desired tension immediately. If then the thread does not "pull" properly, as may happen once in a while, it is evident that the spring itself may have some slight defect that has escaped the shop inspector, and the shuttle is laid aside for a new spring.

The shuttles are handled about the shop in trays that prevent them from becoming nicked or otherwise marred as they approach a finished condition, and in Fig. 11 several such trays are visible upon the bench.

Overcoming Chattering on a Lathe

BY DAVID FARNIE

Occasionally a machinist gets a casting to turn that is too large for his lathe, or the overhang from the chuck or faceplate is too great, causing a great deal of chattering. Tightening the boxes and stiffening the tool support are usually not sufficient to eliminate it.

A good way is to run the lathe on the reverse belt, and turn the tool upside down; this prevents the casting from jumping and riding on the tool. I found also that I could take a heavier cut through a rough hole or one that was out of true, thereby getting under the skin of the casting quicker and saving the tool.

Electro-Magnet for Shop Oculists

BY ROBERT GRIMSHAW

In every machine shop, from time to time, someone gets a sliver of iron or steel in his eye. The usual way to remove these unwelcome and painful intruders is to fold back the eyelid and fish for them more or less skilfully with some blunt-pointed instrument; the best —but perhaps the least frequently employed—being the point of an ordinary "lead" pencil. Still better, in most cases, is the use of a strong magnet, although, as a rule, this is not available.

One form just brought out in Germany, and which is probably little known in the United States, is illustrated herewith, as made by the Magnet-Werke, of Eisenach. It requires hardly any explanation, being simply a small solenoid magnet (arranged for continuous current only) weighing 3 German, or 3.3 English, pounds. The pole points are nickel plated, and may be screwed off and on; hence, after using, they can be sterilized, a most important precaution in these days. They are wound for 4, 10, 50, 65, 110 and 220 volts; and take respectively 8, 3, 0.65, 0.5, 0.3, and 0.15 amperes of current.

THE ELECTRO-MAGNET IN USE

From a paper dealing with the composition and treatment of iron and steel it is noted that the center of a casting is always coarser grained and weaker than the surface. Removing the skin of a casting reduces its strength per unit of cross-section. Bars cast horizontally are more uniform in strength and size than those cast vertically.

Blueprint Washing and Drying

By A. B. Reynders *

A special machine for handling blueprints in sheets cut to finished size, having a capacity of 10,000 1½x2-*foot prints in eight hours.*

*Assistant to manager of engineering, Westinghouse Electric and Manufacturing Company.

In the production of blueprints the washing and drying process is usually considered an unimportant item. If the number of prints is small the washing is done in tubs by boys; the prints are then dried either in an oven or else by hanging on lines in the open air.

Recently the attention of blueprint designers has been directed to the production of a machine for automatically washing and drying the prints. Unfortunately all such machines are built to wash and dry the prints in a continuous roll instead of in sheets cut to the size of the tracing. In order to handle blueprints in sheets cut to the finished size, the users of a large number of prints have developed for their own needs a machine to fulfill this requirement of economical production.

Below is described a machine which has been in continuous operation for four years by the Westinghouse Electric ana Manufacturing Company.

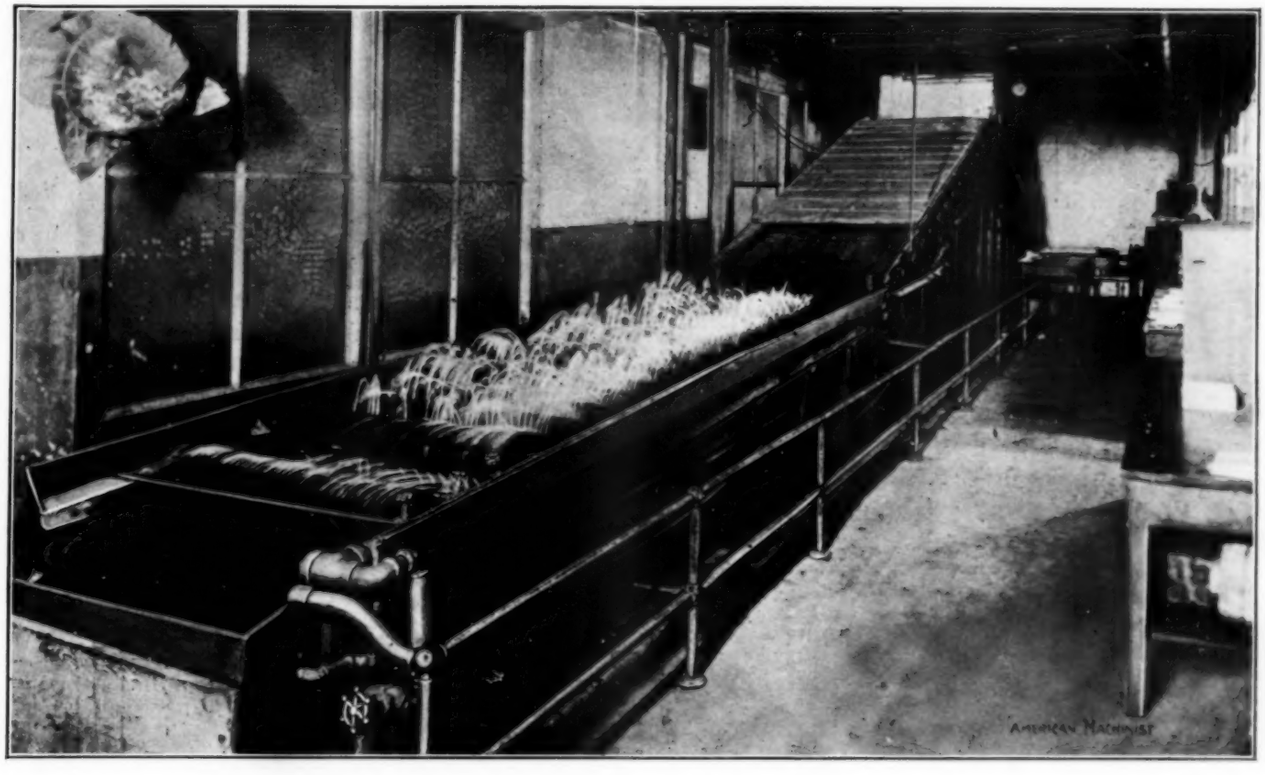


FIG. 1. BLUEPRINT WASHING AND DRYING MACHINE

This machine will wash and dry prints in sheets up to 48 inches wide by any length at the rate of 18 linear feet per minute. This means that the maximum capacity is about 10,000 blueprints (2 x 1½ inches) per day of eight working hours. Two operators are required, one for feeding in the unwashed prints at one end, and one for removing the washed and dried prints and distributing at the other end.

The general appearance of this machine is shown by Fig. 1.

It consists essentially of three inclined planes, each composed of a series of disk rollers, see Fig. 2, over the surface of which the blueprint paper travels while it is being washed and dried. Washing is accomplished by a spray of water falling from a set of pipes located over the washing rolls, and drying, by heated air rising from a series of gas jets located beneath the drying rollers. The washing end occupies a floor space 18½ feet long by 5 feet wide, the drying end 25 feet long by 5 feet, making a total floor space of 43½ feet by 5 feet. The maximum width of print which this machine will wash and dry is 48 inches.

THE WASHING SECTION

This section consists of a series of 65 disk rollers, arranged in a plane, having a slope to the horizontal of ⅝ inch to the foot. Each roller is composed of 74 thin disks of zinc spaced ⅝ inch center to center. The centers of adjacent rollers are so arranged that the disks are meshed with each other; see Fig. 3. For the first 4 feet the outside diameters of the disk rollers are the same, after which each roller is increased uniformly in diameter until the draining section is reached. The object of this gradual increase in diameter will be explained later. About 4 inches above the surface of this set of 65 disk rollers, there is a set of 22 brass pipes uniformly spaced. Each pipe contains a series of holes so arranged that the water will spray upward in a large number of streams, which in falling down covers the entire surface of the blue print as it passes along underneath. Underneath the rollers is a trough of wood, lined with zinc, which gathers the water and returns it to a metal trough at the end of the inclined surface.

The disk rollers are driven by means of sprockets on the ends of the shafts of the rollers; adjacent rollers having the

sprockets on opposite sides. Over these sprockets passes a chain driven from a countershaft, which in turn is driven by means of a sprocket and a chain transmission from a back-geared, three horsepower motor. In order to prevent the chain from lifting off the teeth of the sprockets an angle iron guide strip is fastened immediately above the chain. As the chain is a high-grade roller type and kept well lubricated, this arrangement has proved very satisfactory. The speed of the chain being fixed and the size of the sprockets being the same for all disk rollers, the revolutions per minute for each disk roller are fixed. Owing, however, to the increase in diameter of the disk rollers, the print travels faster and faster in its progress toward the draining section. This means that their is a stretching action on the print which eliminates wrinkles, which would otherwise occur, due to the paper becoming wet.

The total length of time a print remains under the spray is 1¼ minutes. The quality of water flowing may be varied by means of a valve; the minimum being maintained at about 80 gallons per minute. It will be readily seen that this quantity of water is more than enough to wash the prints provided a sufficient time is allowed. In order to overcome the expense involved in using this quantity of water, the water instead of being allowed to run to waste, is pumped over again by means of a centrifugal pump driven from the above mentioned motor; only enough fresh water being supplied to wash the prints thoroughly. This is accomplished by collecting the water through a screen at the front end of the washing section in a trough from which it is pumped. An overflow pipe is provided in this trough for waste, which is kept constant by the supply of fresn water from the public service mentioned above. This can be regulated by means of a valve so that any desired quantity of fresh water can be added. For 450 prints per hour (1350 square feet) 18 to 20 gallons per minute are used.

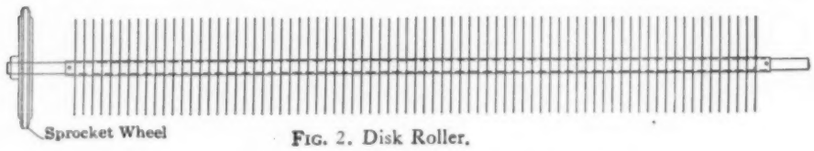


FIG. 2. Disk Roller.

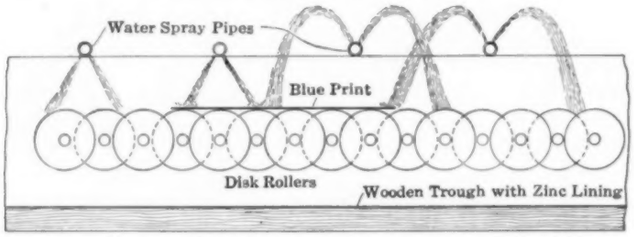


FIG. 3. Principle of the Washing Section.

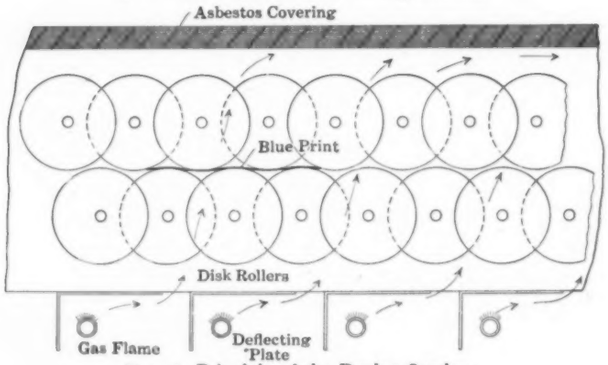
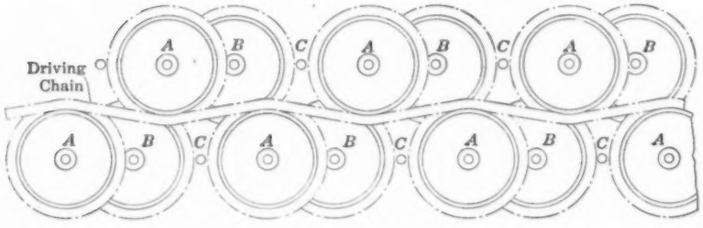


FIG. 4. Principle of the Drying Section.



Sprockets *A* are Driven by One Chain on one side.
Sprockets *B* are Driven by a Second Chain on same side.
Sprockets *C* are Driven by a Third Chain on opposite side.

FIG. 5. Method of Driving Disk Rollers. American Machinist

ARRANGEMENT OF PARTS OF THE BLUEPRINT WASHING AND DRYING MACHINE

THE DRAINING AND DRYING SECTION

This section is arranged lengthwise in the form of an inverted V. It contains 140 disk rollers, all of the same diameter, arranged in two planes, one on top of the other; adjacent disks in the same plane meshing with each other as in the washing section. Between these two planes there is a 1/16-inch space through which the blueprint travels in a sinuous course; see Fig. 4. The object of this is to positively drive the prints which otherwise, owing to the rising of the heat, would be lifted from the rollers and the friction would be so little that the paper would either stand still or slip down the slope.

The first four feet of disk rollers adjacent to the washing end constitute the draining section. Each roller is made of 74 thin disks of zinc spaced ⅝ inch center to center. As the plane of the rollers is inclined at a steep angle, with the horizontal (4¼ inches to the foot) the water readily drains off, being assisted materially by the edges of the disks.

The remaining disk rollers, each containing 74 thin disks of sheet steel, spaced ⅝ inch center to center, constitute the drying section; the drying being accomplished by heat generated from a series of gas jets uniformly spaced beneath the lower set of rollers. In order to prevent the gas flames from igniting the prints passing through the machine, especially when dry, the gas flames impinge upon sheet-metal plates immediately beneath the rollers, the plates being L-shaped to prevent the drafts from blowing out the gas; see Fig. 4. Considerable trouble was experienced at first with the gas jet, which consisted of holes in an ordinary piece of pipe, one end of which was plugged, the other end being attached to the supply service through a mixing valve. A white flame was obtained almost invariably if a large jet was wanted. The trouble entirely disappeared when a series of slots cut crosswise to the pipe were substituted for the many holes.

The shape of the drying section was made in the form of an inverted V in order that full advantage of the heat could be obtained. Air enters at each end, which when heated, arises toward the middle and escapes moisture laden through an opening at the apex of the V. Further, the travel of the prints over the apex causes any drops of water remaining at the bottom edge to flow in the opposite direction over the dry surface, with a result that the prints are free from a

damp edge, so frequently seen in oven-dried prints.

In order to retain the heat, the top series of disk rollers are covered with shallow sheet-iron pans filled with heat insulating material such as asbestos. These pans are arranged to be removed readily for inspection and the removal of foreign articles, such as hammers, sticks, etc., which are dropped into the rollers accidentally or otherwise.

The rollers are driven by sprockets (on the ends of the shafts of the disk rollers) between which in a sinuous path passes a roller sprocket chain, two chains being on one side and one on the other, as shown in Fig. 5. These chains are driven from a countershaft which is itself driven by a chain transmission from the 3-horsepower Westinghouse induction motor mentioned above.

The time for an average print 19 inches by 25 inches to pass through the drying section of the machine is 1¼ minutes.

The problem of lubricating 410 bearings economically, some being flooded with water while others nearly 212 degrees Fahrenheit, was solved by the use of a compression grease cup, filled with a high melting point grease on the end of each shaft.

The Knight Gasolene Engine

The engravings show the construction of the Knight engine which has been adopted for the Panhard automobile in France and by the Columbia in this country. Although originally known as the "valveless," it is now more properly described as having "sleeve valves" as can be seen. These are driven by the short connecting rods from the cam or eccentric shaft shown and admit or exhaust the gas when the ports in the two sleeves register. The water jacketing is particularly thorough and, as can be seen, two spark plugs are provided in each cylinder. The illustrations were supplied by the Columbia Motor Car Campany.

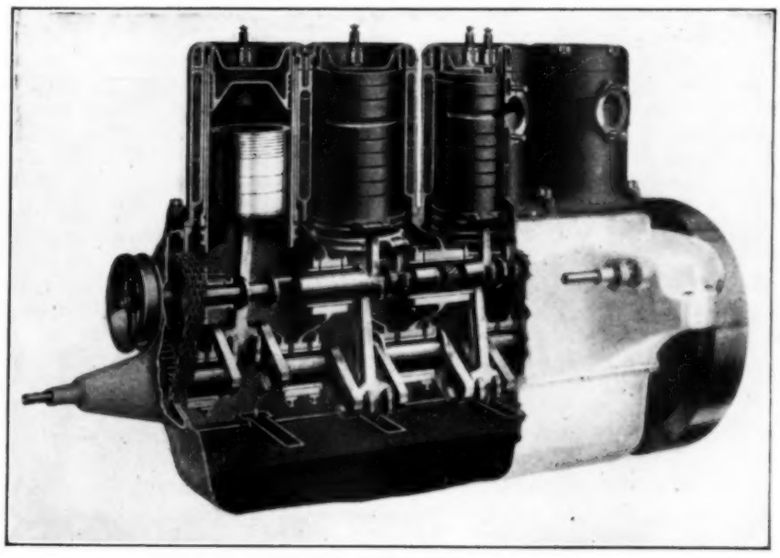


FIG. 1. COLUMBIA-KNIGHT MOTOR

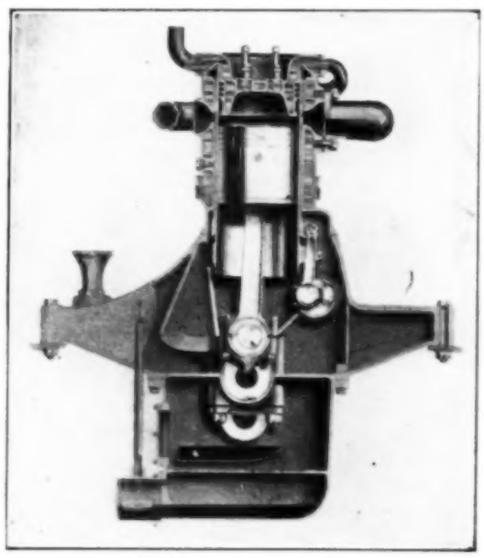


FIG. 2. CROSS-SECTION VIEW

Compulsory Education

BY ENTROPY

To the mature lay mind it would seem that education was simply a matter of providing the equipment and the instruction. As a matter of fact the providing of students is by far the larger part. If all our schools were merely free schools, the attendance would be a very small part of what it is now. In the lower schools the small boy who prefers to go fishing or to a ball game does not reduce the percentage of attendance as the parent does when he keeps Johnny out to mind the store, or run errands, or for any one of a hundred semi-legitimate reasons. Parents and children are alike indifferent to the necessity of punctuality or regularity of attendance, however much they may appreciate its ultimate benefits.

The very fact that public schools are free may have something to do with this condition of affairs; on the other hand, it is certain that if attendance were not compulsory, the very boys and girls who used the schooling most would not take advantage of it. Free, non-compulsory education is generally taken advantage of only by those who would have educated themselves in some way even if a free school was not available. This is nowhere better illustrated than in colleges and technical schools. Partly through severe entrance requirements and partly through lack of ambition, but a very small percentage of boys go through college, technical or otherwise, and even this small percentage is largely recruited by a process of misunderstanding.

College catalogs usually state nothing except the truth. They point with pride to this, that and the other great man as an alumnus, but they do not mention the fact that he only got through on a fluke, or that he had to act as chauffeur on a wheelbarrow for a few years before he got his bearings and began to climb. Then again most boys are influenced in their choice of school by their friends who are in school, and not by graduates, and these undergraduates almost invariably have an attitude toward the school which seems to say: "Here I am and I expect you to make a great engineer out of me while I wait, and while I wait I will try to get as little for my money as possible."

These undergraduates do not come in contact with graduates except as they come back at Commencement chock full of college reminiscences to the exclusion of business matters.

Is it any wonder that college boys live in a glamour of unreality? And is it any wonder that the boys do not come back to the first two or three years' reunions? Yet if it were not for this misunderstanding our colleges would not be half filled.

INDICATION THAT EFFECTIVE EDUCATION MUST BE COMPULSORY

This seems to indicate that effective education must be compulsory or sugar coated in order to reach those who need it most or those whom society most needs to reach. This is exactly as true of trade education as of academic education. The age when a young man can most easily learn new things, when a given amount of practice will produce the greatest results, that is just the age when he is least apt to think of his future. Under the circumstances it would appear to be a good business proposition for the community to require of every young man

that he should acquire skill along some vocational line, and provide him with the means to do so.

I venture to predict that many will live to see the day when the teaching of trades and all other vocations will not only be a regular part of community work, but that the acquiring of a trade or other useful vocation will be made compulsory so far as the capacity of the individual will allow; for unless this is done, there only remains in the large majority of cases the possibility of supplementing daily wage earning by continuation work, such as is carried on in Germany.

While this is much better than no education at all, it is painfully inadequate in view of the rapidly increasing demand for intelligence in trades.

The most pressing demand today appears to us to be for young men who can go into our shops and make good. This requires brains and dexterity. Dexterity implies ability to produce a given result with the smallest waste of energy, whether by the use of the Taylor system or by the use of the experiences of any one of thousands of men who have made patient study, for themselves, of this same thing. This dexterity can only be gotten economically under guidance, it cannot be picked up by working in a shop under the ordinary foreman, except by the exceptional man.

Being Honest with the Other Fellow

By John A. Godfrey

Perhaps that is a bald way to put it, but it is sometimes better to drop honey and syrup and eat our pancakes plain just for a change, and we are a good deal more apt to do this if we realize that we are the other fellow half the time.

There are some buyers who seem to feel that the more trouble and expense they can make the seller, the better. These buyers send for catalogs, ask to have a salesman call, keep him waiting as long as possible to impress him with the idea of the buyer's importance, call him as near a liar about the merits of his machine as they dare, and wind up by attempting to browbeat him on price, if he happens to be selling for a concern that will stand it.

And all because of the mistaken notion that the purchaser is conferring an everlasting favor by buying something that he needs or wants; something that will keep on saving him money long after the cash he paid for it has been used in building other machines of a similar kind; something that he usually will not buy until he actually has to have it.

Whenever we keep a man waiting longer than necessary, or ask him to call when we know it means useless expense, we are taking money that does not belong to us just as much as though we sneaked it out of his trousers pocket when he was not looking.

We should remember that every dollar spent in this way must be added to the cost of the machine, which we and others must pay and that our own traveling men are held up and our own money wasted in exactly the same way.

Getting Expert Advice for Nothing

One of the nerviest things in this line that I know of was worked on a firm who had devised a lot of special methods for doing work and who had installed a planning department—*à la* Taylor—for the purpose of helping customers get the best results from their machines.

So, after a long seance with the salesman, the proposed customer gave him a wad of blueprints of different parts of his work and asked for methods and estimates of the time taken. In due time, after a small-sized barrel of money had been used in preparing the information, the method, plans and estimates were submitted. But the order was not forthcoming, even after repeated visits and exhortations, until the alleged probable purchaser calmly admitted that he had no idea of buying but that he only hoped to get some new ideas to apply on the machines he already had.

And then the aforesaid alleged buyer hotly resented the imputation made by the overwrought and exasperated salesman that he was guilty of any impropriety which might even approach dishonesty within a hundred miles.

While it is extremely difficult to lay down any hard and fast rules as to what is honest or dishonest in such matters, it seems to be a pretty fair gage if we ask ourselves how we would consider the matter if the other fellow worked the same game on us.

Obtaining Money under False Pretenses

Perhaps this is another rather rash statement and yet nothing else seems to exactly fill the bill. Two cases have come to my notice recently but no doubt they will recall similar cases to the mind of every machine builder who is rash enough to read this.

A piece of work was sent to the builder of a special machine with a request for an estimate as to the time required for it and on the strength of this estimate, a machine was ordered to do the work. In the meantime the construction of the piece had been changed so as to require considerably more machining and, as was to be expected, it took a considerably longer time than the original estimate, although the purchaser had seen the original work done within the time specified.

He immediately puts up a vigorous kick about the machine not living up to its guarantee, ignoring the fact that the conditions are entirely different and demands a substantial reduction in the price of the machine.

The builder of the machine is naturally incensed over the injustice of the affair and his feelings are not mollified to any noticeable degree when he learns that, in spite of the increased work to be done on the piece in question, his machine is doing the work in about one-third the time formerly required to do the old piece. This strengthens his conviction that he is being imposed on and he promptly refuses to make any concession whatever and demands either the cash or the return of the machine at once.

As is to be expected, the buyer pays for the machine rather than lose the saving which it is making for him, but he is very apt to "damn the machine with faint praise," whenever anyone inquires how it is doing.

A somewhat similar instance which can hardly be characterized by any other name than sharp practice, is where a buyer demands a certain change in a machine, claiming that without this it is unfitted for his work. And then, when the builder allows him to deduct a substantial sum from the price in order that he may make the change himself, continues using the machine as it was originally built. Of course, in many cases the amounts involved are altogether too small to warrant law suits and the easiest way may be to forget all about them, but this is not easy to do and the idea of being "done," even for a small sum, is very apt to rankle for a long time.

Lest I should be called pessimistic and as an antidote to the foregoing, I want to tell of a case where a machine builder put himself in the other fellow's place.

One morning the builder of a patented machine was surprised if not entirely paralyzed, to receive a letter from another machine builder in somewhat similar line which read something like this: "I have just discovered that on two machines recently built I used a device which was patented by you some time ago and which had never come to my attention. These machines are now in use and I shall be glad to pay a reasonable royalty for them, if you will name the amount. Needless to say I have discontinued this device and am endeavoring to perfect one which will not infringe your patent."

When the recipient of the letter had recovered sufficiently to show signs of life, he called his stenographer and wrote an appreciative reply, giving him the use of the device on the machines already built and telling him that he intended to have the letter framed in gold to prove that there was at least one honest man in that line of business.

Pattern Making and Equipment

By W. S. Giele

What follows has been extracted from a paper presented before the May meeting of the Allied Foundrymen's Association in Pittsburg, as being of interest to readers of the AMERICAN MACHINIST whose work lies along these lines.

Some special methods of parting, arranging and mounting patterns to facilitate and cheapen the molding process, especially in repetition work.

Extensive use of follow boards and match plates, with some kinks for locating the pattern halves on the boards without measurement.

Placing green-sand cores in the mold by means of core boxes with ears to match those on the cope flask, thus obviating handling and possible breakage of the cores.

AUTOMOBILE CASTINGS

The successful making of automobile cylinders is generally conceded to be one of the most difficult branches of the art, both on account of the intricacy of these comparatively light castings and the rigid inspection to which they are subjected.

E. T. Doddridge, pattern expert with the Osborn Manufacturing Company, of Cleveland, Ohio, was, for several years, in charge of the pattern equipment of the largest concern in the country engaged in the casting of automobile and gas-engine cylinders.

The following is quoted from a letter written by him:

"In the first place, it is necessary to determine the method of making the casting to insure a clean and perfect one, true to the pattern. The usual practice and most successful on this class is making the casting on end, this being determined, however, by the style and general shape of the cylinder, as well as the convenience and safety in placing the cores and taking off the vents.

"Parting lines are usually determined for the easiest and surest way of placing the cores in the mold, and not, as in the case of most patterns, by the easiest way to make the mold. Any undercuts, facings and core prints can then be taken care of by running extra core prints to the parting line, in order to make the joint straight for ease in putting the pattern on the molding machine, as nearly all such patterns are now made on machines of one kind or another.

"Right here arises the question of the type of machine to use. As a general proposition, unless it is a four-barreled cylinder, having a part of the crank cases cast on, or an extra large one, which would require several bars in both cope and drag, it has been the writer's experience that a machine of the flask-stripping type, or an ordinary stripping-plate machine, gives the best results, both as to speed and accuracy, the preference being given to the flask-stripping machine on account of the cheapness with which the pattern can be mounted, as well as the fact that when the pattern and plate are drawn, the flask pins come with the plate and the flask itself is clear of everything.

"Sometimes, however, it is preferable to make the drag on a roll-over machine, on account of not having to bar the drag flask, and the cope on a flask-stripping machine. This method is usually the better one when the pattern used is a cylinder of the larger type and made in green sand. The coreboxes should be carefully considered, not with the idea of making as few cores as possible, but making the cores accurately, easily assembled and pasted, as well as placed in the mold with the least trouble, always bearing in mind, however, that a good, clean casting is the desired end.

"The question of flasks is also very important, and the possibility of making standard flasks, pins, plates, etc., for this kind of work is a great one, and a little thought along this line will save a firm considerable money in the course of a few months, as the flask expense is usually one which is quite an item.

"In making flasks for use on molding machines, accuracy in drilling the holes and fitting the pins is absolutely necessary, as well as having the flasks true on the joints. Poor results obtained from an otherwise perfect equipment will nearly always be traceable to imperfect flasks.

"The question of pattern equipment is one of prime importance, and usually a little time spent on a pattern, not merely to put a fine polish on it, but to make the pattern in such a way as to give the best results in foundry and core room, will pay many times over, especially on duplicate work such as this."

In considering crank cases and similar castings, so largely used in motor-car construction, we have an interesting opportunity to compare the diverse solutions of the same problem developed in different shops.

In a cast-iron sanitary-ware shop the pattern for a piece of this type has been observed made up complete in metal, follow boarded, the whole mold being rammed up in green sand.

Similar practice has been observed in stove shops on similar pieces, but in view of more recent developments in this line, one would rather expect either a matchplate against one side of which the drag would be rammed, and the opposite side of which would form the cope, or two mating matchplates, one for cope and one for drag, each backed with plaster or other composition for support.

In a motor-car shop we find the drag pattern (plane parting in this case) fastened to a board against which the drag is rammed, corresponding to the matchplate referred to above, but the cope instead of being rammed against a cope matchplate is rammed against a plane surface, the inner side of the casting being formed by a dry-sand core hung from it.

The writer would not care to venture an opinion as to which of these three methods is the best, nor even to attempt the statement of a general rule which would define the circumstances under which any one should be given preference over the others. There are so many variables involved that each case must be decided on its own merits. In general, it will probably be conceded that either the follow-boarded pattern or the matchplate process would show a higher first cost for patterns than the dry-sand core arrangement, and offer less opportunity for changes in the pattern than the latter.

Against the lower pattern cost we have the expense of making, drying, handling and setting the core. The follow-boarded pattern requires the handling of both follow board and pattern, cannot conveniently be handled on the molding machine and is more liable to damage than either of the other two.

The matchplate can be used with or without the machine. Whether made in one piece, or as a pair, it affords good protection to the pattern, the separate plate for cope and drag permitting the strongest possible support for the pattern surface. The latter construction often permits effective team work in the foundry, one man working on copes, the other on drags, and both together doing the lifting. This division of labor is practised in both machine and hand-molding.

The dry-sand core method is perhaps to be preferred to the others, where a fewer number of castings is required or

where alterations may be necessary. Both pattern and core box can be made comparatively rigid of wood, and thus permit more rapid work in the pattern shop. The same division of labor in molding can be practised with this equipment as with separate cope and drag matchplates.

Textile Machinery

Textile machinery is older than machine tools, so that it is only natural to expect practices in this industry well developed and boiled down to high efficiency by the elimination of the unfit through years of experience.

Although this product is now machined and assembled by modern methods in the progressive establishments, the old days of laborious hand-work in fitting together pieces of such considerable size as the side frames and cross girts of looms have left their mark in the comparatively high degree of accuracy and finish demanded in the castings.

I found at the plant of the Crompton & Knowles Loom Works in Philadelphia a very strong tendency toward attaining this end through the extensive use of molding machines, and the molding-machine practice developed to a degree of efficiency and simplicity which has its lesson for the founder in any line.

Patterns for such large castings as the side frames and cross girts already referred to are made of wood, parted on a plane, wherever possible, in the usual way and molded on the floor with a follow board.

There are in addition a very large number of smaller parts which belong to the general run of small machine parts, and patterns for these are made very generally of wood. The number of castings from any one pattern going into a complete machine is not great, and as the machines are of considerable size, and made in a great variety of styles, the use of wood patterns needs no further comment. The same conditions control the methods of mounting the patterns.

The plant to which reference has been made has solved the latter problem by adhering to plane partings as far as it is possible to do so. Where bosses or lugs fall off the parting plane, cores are used in preference to an irregular parting.

The pattern boards are made of pine, thoroughly seasoned, but not as carefully selected with regard to knots or other blemishes as pattern lumber would be. These boards are found amply durable for the service required of them, and are so inexpensive that mounting of a large number of patterns, which are perhaps used only occasionally, is not a serious item.

The protection which the board gives the pattern, not only in the foundry, but in the pattern storage, is an item of considerable weight. Every molder knows that one of the most prolific causes of ragged molds from split wood patterns is the back draft resulting from the breaking and wearing away of the edges of the pattern adjacent to the joint, and every patternmaker knows that these edges are first watersoaked by the molder's sponge and then broken by kicking the patterns around the sand pile. Patternmakers know, too, that no matter where rapping plates and draw plates are placed, the molder will find it necessary to drive his spike elsewhere. So the pattern board serves many useful purposes.

In storing patterns on boards it is only necessary to erect uprights, spaced according to the flask sizes and slide the boards in on ledges nailed to these. The uniformity thus secured simplifies the storage question wonderfully.

In mounting the patterns an ordinary mold in an ordinary flask is rammed up from the split wood pattern just as in making any casting. The mold is now separated with the corresponding half patterns left in the half molds, the drag board laid on the drag and the cope board laid on the cope, and both rolled over with boards down.

By digging down into the sand it is easily possible to drive a couple of brads through the patterns into the boards, and after removing the boards to fasten the patterns to each where located, and the job is done. It is easily possible to mount an average pattern in this way in 20 minutes, and, therefore, not hard to believe the statement that it pays to mount patterns in this way for ten molds.

This interesting method exemplifies in a striking manner that the simple, sure way of proceeding by logical steps is in the end the most efficient.

Not a single piece of special equipment is required to do the job, and, while not a single measurement is made, the job is located with perfect accuracy because the pattern is located on the board by the mold exactly as the board must locate it in the mold later, and the board is located by the flask exactly as it must later locate the flask. A mistake is impossible.

There are, of course, jobs on which a plane parting cannot be secured even by the use of cores.

These are handled with almost equal simplicity by making an ordinary litharge and sand match rammed against a half-mold as usual. The cope plate to go with this is made by removing the pattern from this match and ramming another match against the first.

This latter will then be an exact mate of the parting surface already formed, bearing an exact duplicate of that portion of the pattern buried in the first match.

By fastening the pattern into the first match a pair of pattern plates for cope and drag is secured by a process just as simple and just as accurate as that described for plane partings. This process is thus applicable to patterns which are not split. Slender projections, which would not stand well in sand, can be made of wood or metal and rammed into the match.

Still another interesting feature is the making of hollow frames and similar shapes, in which the metal is so thin that it would be almost impossible to cast them with dry-sand cores on account of shrinkage cracks, arising through failure of the core to crush.

Some of these are made from metal patterns in three-part molds, but a more original and ingenious way, due to Mr. McCleary, of the Crompton & Knowles Loom Works, consists in ramming the drag in a barred flask and then ramming up a green-sand core in a box with ears exactly like those on the cope flask.

After having rammed the cope, and drawn the pattern, the drag is placed on the core box, the whole rolled back with the drag in its normal position, and the core box lifted off, leaving the green-sand core in the mold. The mold is then closed in the ordinary way.

This clever expedient for avoiding the difficulty of setting a green-sand core deserves a tribute to Yankee ingenuity.

I found in Mr. McCleary another enthusiastic advocate of the arrangement of patternmakers' work benches with their left ends toward the windows, the foreman's position being at the end of the line. With this arrangement some little clearance should be left between the wall and the left end of the bench, but wherever space will permit this clearance should not be occupied by the tool chest, as most of the shavings fall at the left end of the bench.

Mr. McCleary has provided a vertical tool cupboard over the right end of each bench, which all the men use, storing their own tool chests elsewhere. He has also installed a small bench trimmer at the right end of each bench—a wonderful time saver.

Lathes, jointers, planers, trimmer, band saw and combination saw table are provided, as is practically universal.

Paper Mill Machinery

The parts of paper-mill machinery, like most of machinery, naturally fall in two classifications—large and small. They are, however, unlike the parts of machine tools or engines, for instance, in that this machinery has to be built special to meet the particular circumstances obtaining in the plant where it is to be used.

There are, therefore, few standard parts which can be used on all machines, or parts of similar design which can be made in a range of sizes.

The completed machines are large and expensive, and a design once built is seldom duplicated in its entirety.

This condition naturally leads to the extensive use of wooden patterns, so made that bosses, pads and core prints can be conveniently moved to suit the varying conditions, and to make right- and left-hand castings from the same pattern.

A typical example of the larger castings used on this class of machinery is the housings, which are commonly made from wood patterns with flat backs rammed up on a plane board. The usual machine elements, such as handles, levers, cranks, gears and bearing caps can, to some extent, be used on different machines. Patterns for these are gated up in wood or metal, as the number of castings required may indicate.

At the plant of the Moore & White Company, Philadelphia, such parts as are used more or less frequently are made up either in wood or metal, and such as do not have plane partings are worked with hard sand matches. Most of these gates are made with lugs for screwing onto vibrator frames for the Tabor Power Ramming Machine. The patterns are stored in their matches and attached to the vibrator frames as needed in the foundry, one vibrator frame for each size flask only being used.

The casting of the rolls for paper machines is one interesting feature, characteristic of the manufacture of such machines. These roll castings must be absolutely sound, without surface defects, as finished castings having such defects would mar or tear the paper.

The rolls are used in considerable numbers and a great variety of sizes. On account of the requirements they are always cast on end, and wherever possible made with a considerable extension at the cope end, which acts as a riser and collects the dirt in the casting, being subsequently cut off.

The smaller sizes of rolls are cast from complete wooden patterns. Where special diameters of rolls are required, these are frequently made up by lagging the wood patterns and cutting out the sand to the lines indicated by the lagging in the mold.

Medium-size rolls are made by the Moore & White Company by a very ingenious method on a Tabor power ramming stripping plate machine.

Four patterns, each equal in length to the depth of the flask, are mounted on the machine. The flasks are then rammed up and stacked to the number required to make the desired length of roll, thus making all lengths of rolls of any one diameter from the one pattern, and permitting molds of a size very much in excess of the capacity of the machine to be built up.

The cores for the rolls are built up of hay rope and mud on an arbor.

The larger sizes of rolls are made from a short section of iron pattern, which is drawn up as the construction of the mold progresses. Cores for these, as well, are made up from hay rope and mud. The largest sizes are made in loam.

Another interesting process, observed in the plant of the Moore & White Company, is in connection with the construction of their speed-changing device, which consists of a pair of cones on which a belt is run. These cones are required in varying diameters and lengths, and in varying proportion of diameters, between large and small end.

This range is covered by a single set of patterns by making all the cones of the same angle and making up the patterns in sections, so that sections can be removed or added to either end of the pattern, thus forming the casting of a small cone from a pattern made up by using the smaller sections of pattern; a cone of larger diameter by dropping off the sections at the small end of the pattern and adding a section or sections at the large end; a long cone having a greater difference of diameter between its ends by adding sections at either or both ends.

The very large sizes of cones are not made in a single casting, but built up of sections forced onto the shaft. The various proportions of cones are built up in the same way as the cone patterns for the smaller sizes; that is, by using larger or smaller sections.

Machine Tools

Parts of machine tools consist essentially of large heavy pieces, such as beds, planer tables, housings, head and tailstocks, etc.; smaller pieces, such as chucks and faceplates, carriages, etc., and still smaller pieces, such as cranks, levers, gears, pulleys, etc.

These castings are almost entirely molded in green sand from complete wood patterns, the number of pieces from any one pattern required seldom warranting the expense of permanent metal patterns, except in the case of some few gears, levers, cranks, cams and possibly bearing caps.

The patterns are seldom made adjustable or changeable, as designs for machine tools are made more or less standard and not varied for different orders, the machines being made up for stock, and the patterns changed only when new designs are made and a new stock is put through.

The wood patterns are, as far as possible, split on the plane of the parting, and such patterns are, therefore, well adapted to mounting on molding machines of the roll-over or jarring type, even when a comparatively small number of castings is required to fill an order.

Small pinion blanks and castings for bushings are frequently made from patterns which are long enough to make several of the finished pieces. These are cast on end with an additional length allowed in the cope, to act as a riser. The cope end of the casting is gripped by the chuck in the lathe when machining these castings and pieces are parted off as finished. The writer has seen this principle carried to large rings for internal gears up to 48 inches in diameter.

In making patterns for machine tools it is well to consider the method by which the castings must subsequently be handled in the machine shop. Where pulleys or gear blanks are gripped in a three-jaw chuck for turning, it is always preferable to use three or six spokes, so that in holding the casting from the inside the chuck jaws will fall in the spaces between spokes, or in holding the casting from the outside the pressure of the chuck jaws will be applied opposite the spokes, thus preventing the distortion of the rim. Particularly in the case of thin parts, such as rings, etc., it is advisable to cast lugs by which the castings may be bolted to the faceplate, coring the lugs for this purpose, so that the castings may not be distorted by clamps or chuck jaws, which would otherwise be required to drive them.

As all of these castings require machining, and usually one side forms an important bearing, or is exposed to view in the finished product, it is often necessary to make the pattern so that it will mold with the machined surface down, to insure the soundness of this part of the casting, even where such a position entails additional expense in the pattern making and molding and core making.

Machined surfaces forming joints which are not sliding bearings are frequently as effective if recessed at the center and machined for bearing at the edges only, and this should be done wherever possible, particularly if the castings are to be milled, as the recess breaks up the chips and permits much heavier cuts and feeds being taken.

If castings are to be finished by disk grinding, the finish should be as small as possible, and the surface broken up by recesses or grooves, to reduce the heating and provide spaces for the material ground away to get from the surface being ground.

Where castings are to be turned, planed or milled, the finish should not be less than $\frac{1}{4}$ inch, so that the point of the cutter will get below the scale and lift the scale off rather than cut through it. It is frequently easier to remove $\frac{1}{8}$ inch, with the point of the cutter constantly under the scale, than to remove less metal when the cutter hits the scale at low points.

Where machining is required at the ends of a casting of any considerable length, or at the sides or top of castings which are apt to spring out of line during cooling, extra finish should be al-

lowed to take care of this contingency. Extra finish on the cope side, to take care of dirt and gas holes, is usually advisable and much cheaper in the long run than the rejection of an otherwise perfect casting on account of such defects.

Chuck bodies and faceplates, when made with dry-sand cores inside, are apt to come oversize in the casting, as the core will not crush sufficiently to allow the casting to take its full shrinkage. Suitable provision should be made in the size of the pattern where this occurs.

Castings for Engines

Castings for engines, as far as shape, number required from a pattern and sizes, compare closely with castings for machine tools.

The patterns are made up in practically the same way. These castings may be roughly subdivided into castings for internal-combustion engines and castings for steam engines, and this general classification may be made to include, as well, castings for pumps and air compressors.

Probably the most difficult castings of this general class are the cylinders, which must be absolutely sound in the bore, and are usually made close grain and comparatively hard, to provide for wear, as well as against leakage.

Cylinders for air compressors are frequently water-jacketed, cylinders for steam engines steam-jacketed, and cylinders for gas engines water-jacketed or provided with heat-radiating ribs.

The cores for such jacketing, as well as the port cores, in addition to the main core forming the bore, complicate the work on the patterns and core boxes and in the foundry.

The general practice is to make the main core for the bore separate, and to assemble the port and jacket cores around them, these latter cores being located, with reference to the main core, by means of prints, as far as possible, though the use of anchors and chaplets is frequently necessary.

The beds, which are the largest castings going into the construction of the engines, are made usually in the same way as beds for machine tools.

The flywheels for small internal-combustion engines, particularly, are now being very extensively made on the various types of molding machines.

Large engines require a variety of flywheels, often combining band-wheels for driving belt or gear-wheels with the flywheel. For this reason the larger sizes are often swept up in loam or built up in cores. This method of building up the mold, using a segmental rim pattern only and a core box containing a half-arm, makes it possible to turn out castings of a size considerably beyond the capacity of the woodworking tools in the pattern shop.

Chain Sprockets

The requirements of the Link Belt Engineering Company have been selected as a good example of a pattern equipment for this line of work, where a great variety of different sized pieces, all of practically the same design, is required.

Their pattern equipment illustrates in a striking manner how standard pattern elements can be combined to meet the different requirements for castings and also where such combinations cannot be made to advantage.

The sprocket patterns for the Ewart chain, which is the ordinary malleable cast-link chain, sometimes referred to as chain belting, are made up complete in iron, as far as the teeth rims and spokes are concerned. The spokes meet in a web at the center of the wheel, all wheels being bored at the center for a 1-inch dowel.

All hub patterns are furnished with 1-inch dowel pins, so that any hub can be used on any wheel pattern.

The wheel patterns vary in diameter, in number of teeth and pitch of teeth.

The hubs are made to correspond to the diameter of the shaft on which they are to be used, the different pitches of chain and specifications for setscrews or keys.

Setscrews and keys make it necessary to vary the amount of metal allowed in the hub for any particular size of bore. Thus a sprocket of a given diameter and given bore would have a heavier hub for a large-pitch chain than for a small-pitch chain, and a still heavier hub if keyway is required.

None of these patterns are mounted for molding use, as it would not be possible to make up a stock of castings in advance, there being so many variables involved.

If a stock of castings, for instance, were made up for any given pitch and number of teeth, the hubs might not be of the right size, or, if the hub and pitch were right, the number of teeth might not be what was required.

A slight variation from these patterns is in those made for what is known as the "flint rim" sprocket, in which case the pattern does not have the teeth, but a print around the edge, which receives the chill for chilling the teeth and rim.

Cast-tooth Spur and Bevel Gears

This company has its patterns for cast-tooth spur and bevel gears made up in the same way. All the gear and sprocket patterns take two kinds of interchangeable hubs, the one for a solid wheel, the other for a split wheel, the split-wheel hub pattern having prints for splitting cores and also for cores for the bolts by which the hub is bolted together. Where a wheel is made with the split hub, two lugs carrying a splitting core print and bolting core prints are fitted to the rim.

In such cases, as wooden patterns for tooth gears are used, the teeth are not dovetailed into the rim, but their position is indicated by center lines on the rim and on each individual tooth, the teeth being held in place by corrugated sheet-metal fasteners driven half into the tooth and half into the rim. This makes a very much cheaper pattern than dovetailed teeth, and it has been the experience of the Link-Belt Company that patterns so made are very satisfactory in service.

The usual finish allowance on the ends of the hubs for iron castings is 3/16 inch each end, 5/16 inch is allowed for finish in diameter of bore for hubs bored up to 2 15/16 inches diameter. For hubs bored larger than 2 15/16 inches, and up to 4 15/16 inches, a 3/8-inch finish is allowed in the diameter, and for hubs bored larger than 4 15/16 inches, a 1/2-inch finish is allowed in the diameter.

In wheels to be cast in steel, the finish allowance in the bore is never less than 1/2 inch in diameter, and up to 2 inches bore the cores are omitted entirely.

Large diameter sheave wheels for rope drives are made from complete wood patterns, using a dry-sand core for the groove in the rim wherever there is but a single groove. Where multiple grooves are required, it is more usual to sweep the rim, using a hub pattern or hub core box and a core box containing a half arm, two cores being used to make each arm, and the hub and arm cores assembled in the mold after the rim has been swept up.

Spools for cable hauls, which have a neck in the center smaller in diameter than the ends, are made by parting the pattern in the center and molding in a three-part flask, the center line of the casting being vertical in the mold.

A rather unusual casting made by the Link Belt Company, for its coal-handling equipment, is the screw-conveyer flight casting, consisting of a hub with part of a helix attached. As the helical portion of this pattern would not draw directly from the sand the hub is made hollow in the pattern and the helix attached to it by thumb screws from the inside.

When drawing the pattern from the mold, the thumb screws are removed and the helical portion of the pattern is screwed out of the mold.

Another rather unusual casting is the drum for the coal crusher. These drums are made from solid cylindrical patterns, which, in effect, consist of a print for the chills, which form the outside of the drum and prints for the cores which hollow out the inside of the casting. The chills form the teeth on the outside of the drum, and are set in the impression left in the mold after withdrawing the pattern.

Milling and Boring Automobile Engine Cylinders

Figs. 1, 2 and 3 show three operations in the machining of cylinders for the E-M-F and the Flanders automobiles.

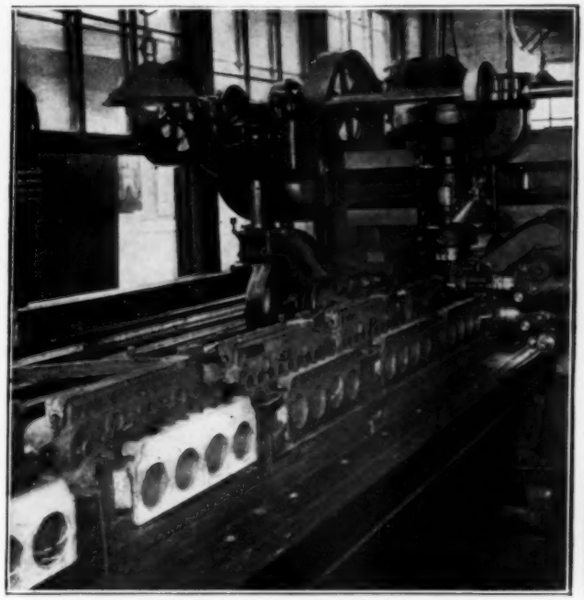


FIG. 1. MILLING E. M. F. CYLINDERS

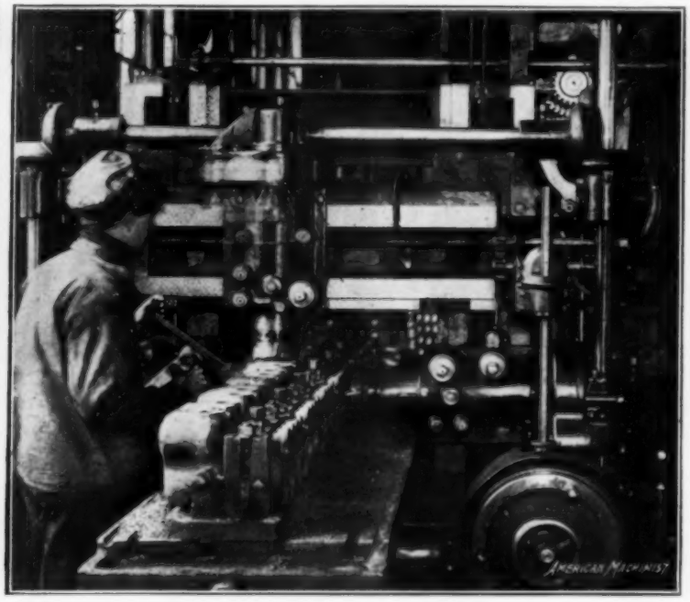


FIG. 2. MILLING FLANDERS CYLINDERS

Fig. 1 shows the E-M-F cylinders which are made in pairs, and are being machined on three-spindle Ingersoll milling machine of the planer type. The milling cutter on the right is finishing the base, while that on the left, which is hidden behind the operator, is facing off the valve openings. The vertical spindle is taking care of the side outlet for the intake and exhaust.

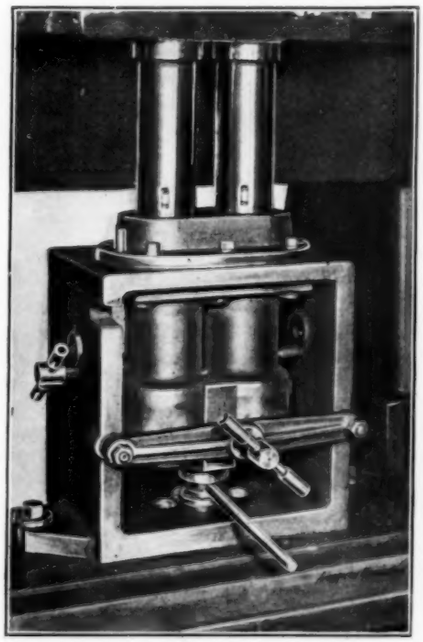


FIG. 3. BORING E. M. F. CYLINDERS

Fig. 2 shows how the cylinders for the Flanders car, which are cast *enbloc*, are milled on another machine of the same type. In this case there are two horizontal spindles on the right-hand side. The lower spindle faces the base of the cylinder castings, the second spindle reaches over the flange on the base and does the spotting for the lower guides of the valve stem.

At the same time the openings on the cylinder heads are being milled by the cutter on the left-hand side, while the vertical cutter mills the face of the openings into the cylinder manifold.

After the cylinders are faced all over and the flanges drilled in this way, they are bored in vertical-spindle boring machines, Fig. 3 showing a two-spindle machine arranged for the cylinders as used in the E-M-F car. This uses the box form of drilling fixture, the jack screw in the bottom working against the cylinder casting and holding it firmly against the upper surface of the jig. The jack screws, shown at the sides, serve to steady the cylinder against the action of the boring bar.

The cylinders are located by dowel pins, one being shown at the left of the boring bar in the face of the located portion on the top of the boring fixture. The work is fed up against the boring cutters.

Piston Ring Turning, Grinding and Slotting

BY E. A. SUVERKROP

In the shops of the National Transit Company, Oil City, Penn., the piston rings from 7 to 30 inches diameter are cast singly and the skin of the casting is left intact on the inside. The rings are cast 1/10 inch oversize in width for turning and grinding and ⅛ inch oversize in diameter for the same purpose. The roughness on the inside is first removed "free hand" on an abrasive wheel of suitable size. The rings are then turned

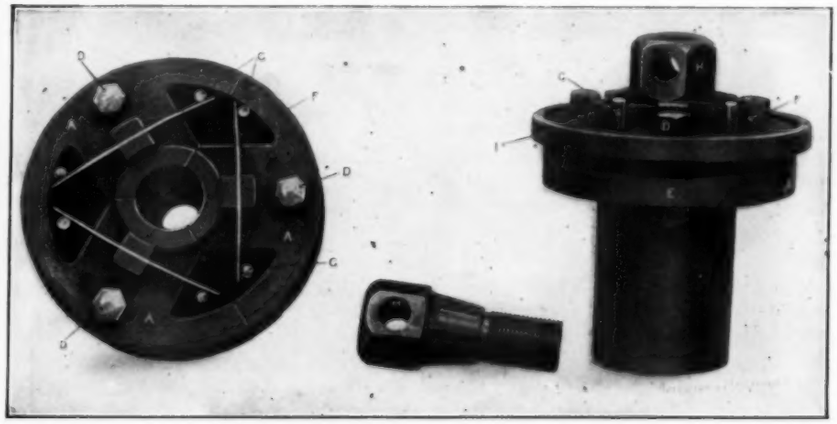


FIG. 1. EXPANDING CHUCK FOR PISTON RINGS

to width. For this the expanding chuck shown in Fig. 1 is used. The three segments *A* have elongated slots through which the bolts *D* are passed to secure them to the body *E*. Each segment is provided with a flat spring *F* which, pressing against the pins *G*, keeps the segments normally forced toward the center.

The expanding chuck body is threaded to fit the spindle of a lathe. The ring *I* is placed as shown over the segments *A* and the taper bodied screw *H* is inserted in the hole in the center. Screwing it in expands the segments and holds the ring securely. A straddle tool then turns the ring to rough width.

After rough turning to width the rings are ground to width on a special grinder in which they are held in a magnetic chuck, after which the rings are cut.

Fig. 2 at *A* shows the turning and grinding mandrels for the outside of the rings. One end *E* of the mandrel *A* is threaded to fit the nose of the lathe spindle. A through hole in the center of *A* permits the mandrel *G* to be driven in for use between the centers of the cylindrical grinder. The other end of the mandrel *A*, marked *F*, is a washer held by six studs and nuts. The split sleeve *C* is bored a neat sliding fit for the split piston rings *D*. These are slipped into it one on top of the other until it is full, care being taken that all the splits in the rings are in a line with each other. The washer *F* is removed from the mandrel *A* which is mounted on the lathe spindle. The sleeve *C* with the rings in it is slid on the mandrel *A*, care being taken that the splits in the rings are at the bottom, so that the rings will be eccentric and thin at the split when turned. The washer *F* is replaced and the nuts tightened up. This clamps the rings between the washer *F* and the flange *E*. The tap bolts in the sleeve are slackened and a wedge driven in the split, which opens the sleeve, permitting its easy removal from the rings. The rings are then turned, leaving enough for grinding in the cylindrical grinder. While the cut is running in the lathe another lot of rings is being loaded on the other mandrel *A*. After the turning is done the mandrel *A*, with the rings still in place, is removed from the lathe, the mandrel *G* is inserted and the job is taken to the grinder.

The two mandrels *A* keep the lathe and grinder busy.

Fig. 3 shows a fixture for sawing the split in rings of any size and at any angle. The fixture is clamped to a miller table: The ring *A* rests on the clamps *B* which are mounted on the bar *C* held in the two bearings shown.

The guide *D* not only supports the ring but centers it. The angle of the slot is regulated by turning the bar *C* in its supports. The supports are provided with clamping screws for clamping the bar *C* at the desired angle.

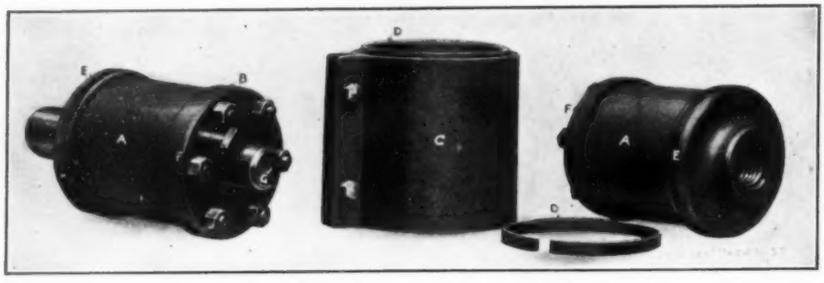


FIG. 2. THE TURNING AND GRINDING MANDRELS

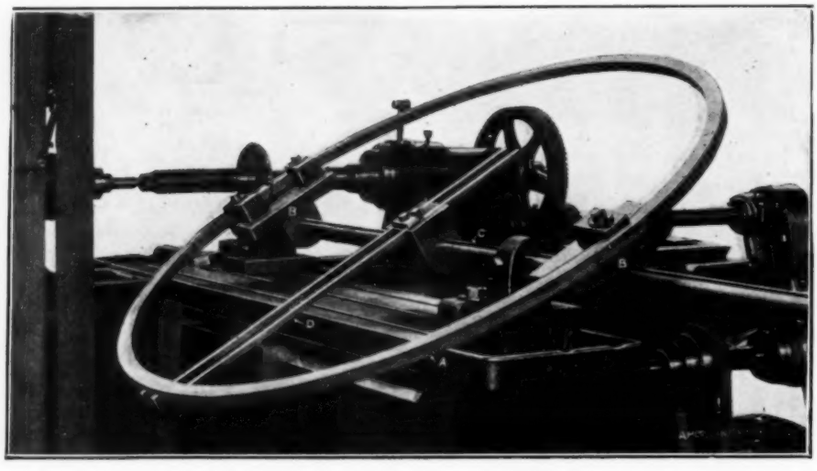


FIG. 3. SAWING THE SLOTS IN LARGE RINGS

Master Collet Repairs

BY F. C. LE MESSURIER

The illustration shows a device I used to overcome the annoyance and expense incident to broken master collets. These collets break at the point marked *A A*, Fig. 1.

The solid flanged plunger *B*, Fig. 2, was made a slide fit in the bore of the turret-lathe spindle. The broken joints of the collet *C* were next ground to rest squarely against flange of *B*. Small holes were drilled in the sides of these sections, as shown for the coil springs, which were inserted to assist in opening the sections when the work was to be taken out.

The work was of such a nature that it could be put in and removed while the machine was in operation, so the centrifugal force also helped in opening the sections when the plunger *D* was drawn back.

The inserts *E E* are of the regular type and are held into the section by fillister-head screws as shown.

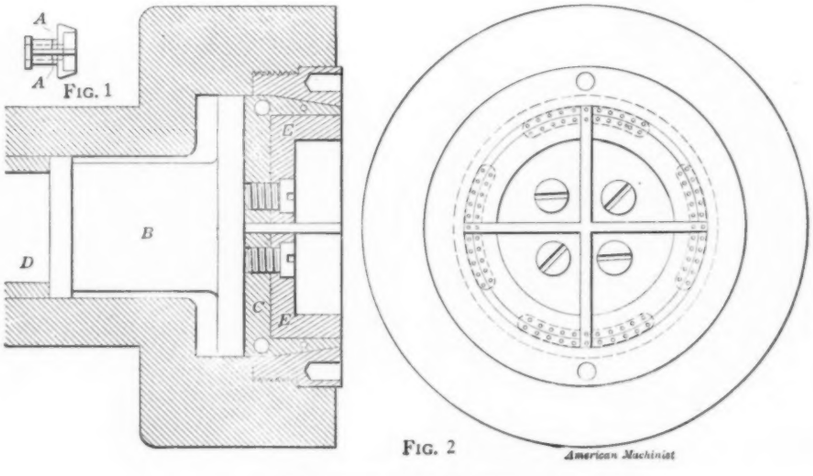


FIG. 1 FIG. 2

MASTER-COLLET REPAIRS

Features of the New Gleason Works

Editorial Correspondence

Solving the car-switching problem by using a transfer table.

The high-powered tungsten lamp for general light distribution.

Those who are interested in making manufacturing cities not only presentable, but attractive, should visit the University Avenue section of Rochester, N. Y., and see what is being done to prevent a fine avenue being spoiled by the erection of unsightly buildings without indulging in elaborate architectural design or going to unnecessary expense. The manufacturers in this section are exhibiting a civic pride which is highly commendable. The new plant of the Gleason Works is in this section and has several interesting features which are unusual in manufacturing plants. The layout of the plant can be readily seen from Fig. 1, and as the buildings shown occupy less than one-quarter the total area of the property, ample room has been left for further growth.

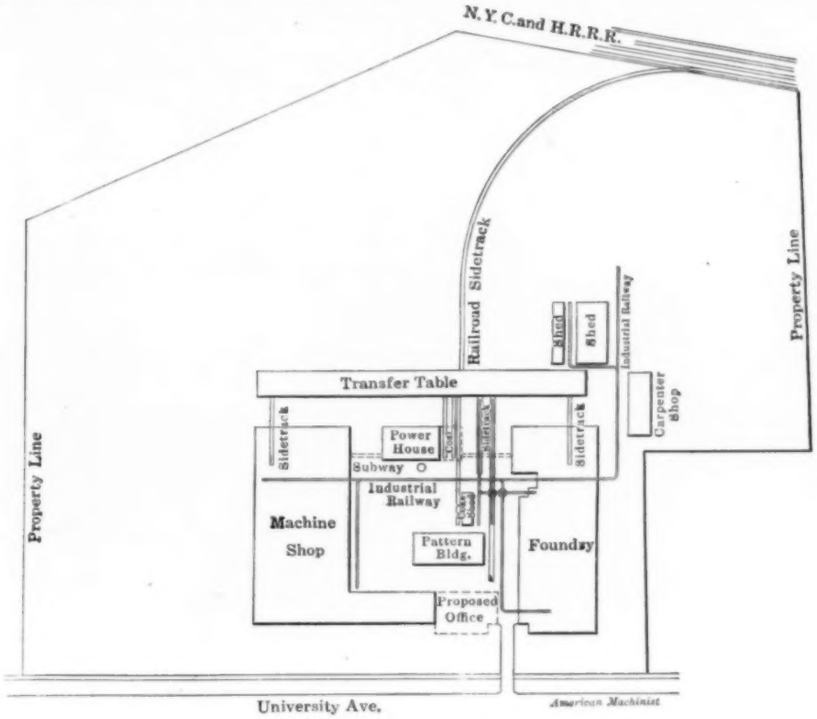


FIG. 1. GENERAL LAYOUT OF THE NEW GLEASON WORKS

A TRANSFER TABLE

The most unusual feature of the plant is the introduction of the transfer table, in place of numerous switches for serving any department of the plant with material direct from the railroad or for shipping finished product.

Switches and numerous side tracks take up considerable room, and if it had been intended to serve both the foundry and machine shop in this way it is easy to see what a bad shaped arrangement of tracks would have been necessary and the room required.

The use of the transfer table is very much the same way as is common in railroad work in transferring locomotives from tenders or cars from one shop to the other. In this case the loaded car of coal, coke, pig iron or whatever the material may be, comes in on the single track from the railroad main line, and is run on the transfer table shown in Fig. 2. It is then moved in either direction until the car comes opposite the short straight track which will deliver it to the desired location and the electric locomotive crane pulls or pushes the car into its proper position. This does away with all switches, and makes it an easy matter to deliver material or to ship finished product without undue delay. The locomotive crane is also very convenient in handling heavy material around the yard, for loading flat cars, or for other purposes.

In addition to this the industrial railway shown makes it easy to handle all material, as, for example, the castings from the foundry can be delivered directly into the end of the machine shop where they are to be operated on. The plan of operation, carrying the work in the direction of the arrows shows that the finished machines are delivered to the cars at the side track shown in the end of the machine shop.

The plan, Fig. 1, will bear considerable study and the advantages of the transfer table's method of handling material, together with the industrial railway, will probably be used to advantage in many cases. It may be said in passing that the end of the foundry which connects to the street is particularly attractive, and is so different from the foundry as ordinarily designed as to lead one completely astray regarding the nature of the building.

A WELL LIGHTED SHOP

The interior view, Fig. 3, was taken for the double purpose of showing the distribution of light by the use of high-power tungsten incandescent lamps as

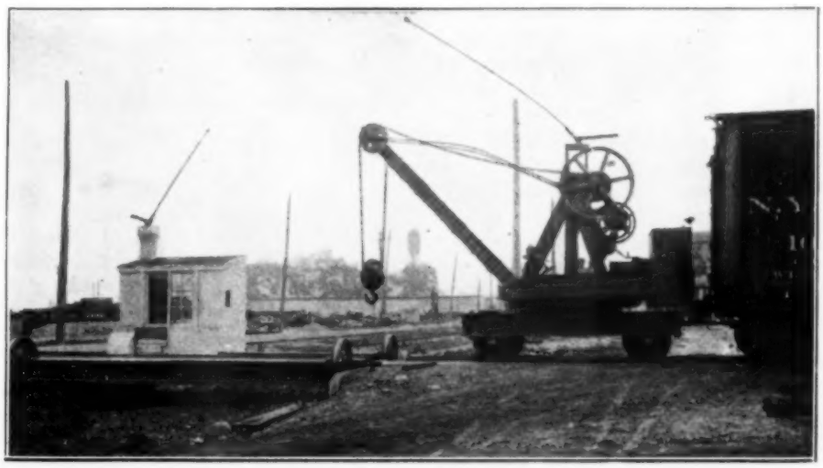


FIG. 2. THE TRANSFER TABLE AND THE LOCOMOTIVE CRANE FOR HANDLING AND LOADING CARS

well as the method of handling the machines during the process of erection.

As before stated, the castings come from the foundry into the lower right-hand corner of the machine shop, and proceed in the direction of the arrows on their road to completion. The view in Fig. 3, shows the left-hand bay of the machine shop, the concrete columns and the dividing wall above them, the distribution of the tungsten lamps between the roof's girders and the single-rail crane tracks along both sides of this bay. This track is provided with a large number of hoists, mostly hand but a few electrically driven, for handling the various parts of the machines, as the assembling proceeds. The traveling crane shown at the further end is only used in the general handling of material, and so far as possible is confined to the heavier pieces. It is particularly useful in loading the completed bevel-gear cutters into the cars for shipment.

One advantage of the small hoist is that an additional hoist can be put on at any time and in any place, so that there need be no delay or crane waits as is often the case where the large overhead crane is depended on for all work of this kind.

The lamps used are 200 watts tungsten, spaced 16-foot centers, and it will be noted that these throw almost no shadow in any of the places where it is necessary to either walk or work. This is particularly noticeable under the projecting end of the machines standing at the extreme left, the floor boards being plainly seen without any semblance of shadow.

No individual lamps are used in the whole shop, and an interesting instance is cited of where an old and valued planer hand missed his individual lamp on moving into the new shop. He was asked by the superintendent to try it without the lamp for a week, and if at the end of that time, he still wanted it, a lamp would be put in for him.

Hearing nothing from him at the end of the month, the superintendent talked to him in regard to it, and was informed that he could see perfectly for all kinds of work, and that he had no need for an individual lamp, which is an extremely good recommendation for the distribution of the light.

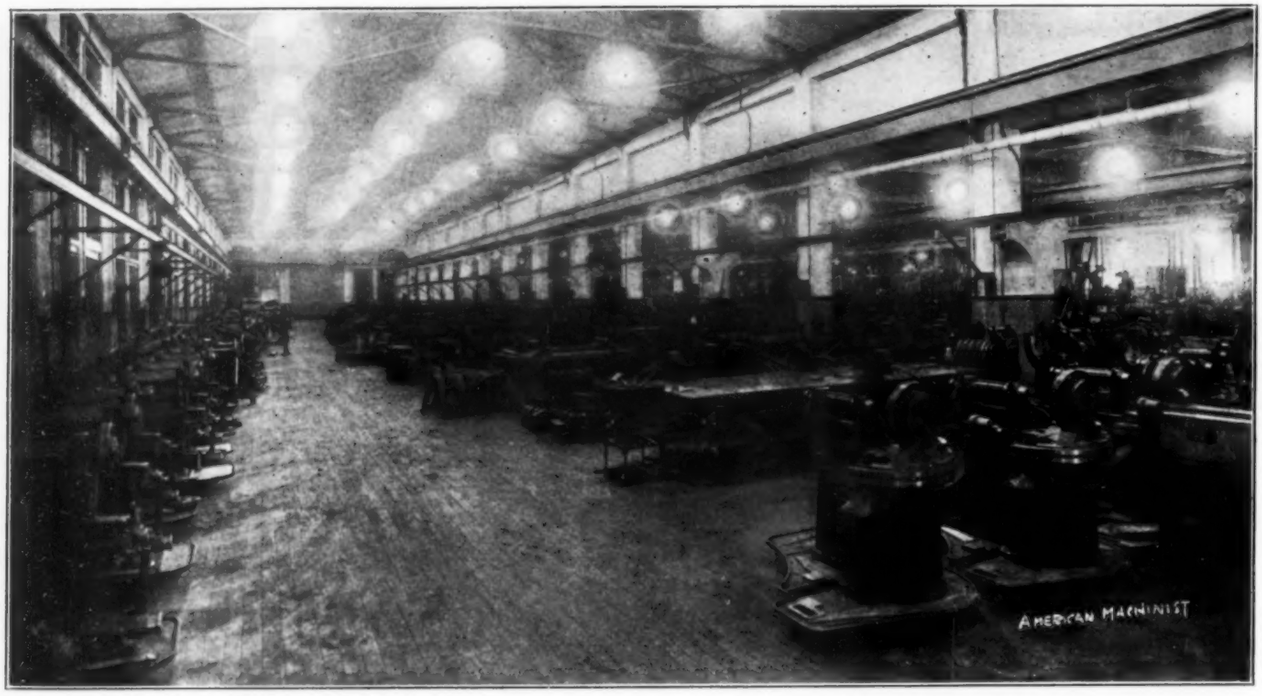


FIG. 3. TAKEN AT 10 P. M. BY ITS OWN ILLUMINATION AND REPRODUCED WITHOUT RETOUCHING. NOTE THE EVEN DISTRIBUTION OF LIGHT AND THE ABSENCE OF STRONG SHADOWS

Old Blueprints Good for Sketch Paper

BY E. B. BIRKENBEUEL

Every drafting office, at various times, meets with the problem of what shall be done with soiled and obsolete blueprints. Sometimes the nature of the work requires the destroying of them to prevent their straying outside the office or shop. To burn them is to destroy the paper as well as the record; furthermore if only a section of the print is not wanted, the whole print must be destroyed.

To bleach the prints, immerse them in a soda bath (4 ounces to one gallon of water); or bleach any section by painting it with the soda solution. Bleaching them thus removes the danger of straying prints and furnishes a fair grade of sketch paper. In offices where printers make their own paper, the bleached sheets are made ready to receive a new record.

It is well to wash the paper in fresh water after bleaching it to prevent discoloring.

Water Annealing

While water annealing is well known to many machinists, one of its advantages is known to few. It is a fact that carbon steel which will not anneal in the ordinary way will often become quite soft and workable when water annealed. The steel should be heated to a red, not hot enough for hardening, and allowed to cool slowly in a dark place. When the red color is just visible in the dark it should be cooled off in strong soda or soap water.

Where no dark corner is convenient the dipping heat can be determined in the following manner:

The hot steel is rubbed with a dry pine stick. Small particles of charred wood will adhere to the steel and glow for an instant. As the steel cools a point will be reached where these particles will cease to glow; when this point is reached the steel is ready to be quenched and practically always gives excellent results.

Irregularity of the Universal Joint

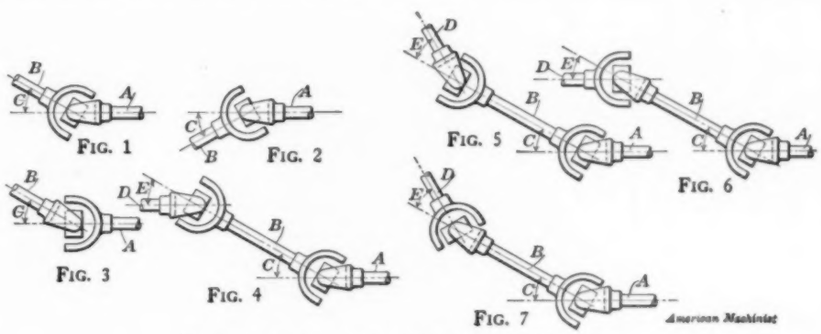
By H. A. Dudgeon

A diagrammatic explanation of the motion transmitted through a single universal joint, and through a pair of joints both wrongly and correctly arranged.

Figures given to back up the argument.

To those who are not familiar with the action of the universal joint, what follows may be of interest. It is intended to treat the matter diagrammatically rather than mathematically, but one or two formulas will be given at the end.

In Fig. 1 let *A* be the driving shaft, *B* the driven shaft, and *C* the angle between the axes of the two shafts. If *A* be revolved in either direction at a uniform speed, starting from the zero position shown, *B* will move from rest the instant *A* moves; but at a slower rate, this being almost uniform at first and gradually increasing its speed, although not at a uniform rate. A position is soon reached at which the angular movements of both *A* and *B* are practically uniform for a short distance, although at this point the total angular movement of *B* is less than that of *A*. From this point onward *B* gains on *A*, slowly at first, but increasing



VARIOUS I-SECTIONS OF THE UNIVERSAL JOINT

in speed to such an extent that when *A* has turned through a total angle of 90 degrees, *B* has made up what it had lost, and the two shafts have turned through an equal angle; namely, 90 degrees.

By referring to the table the relative movements of the two shafts may be clearly seen. The first column gives the angular movement of *A* in degrees; the next column the angular movement of *B* in the same time. The third colunm gives the total lag in angular movement of *B*, and the fourth column the change in angular lag of *B* during the preceding movement of *A*. These figures are given to the nearest minute and, for the purpose of comparison only, are close enough.

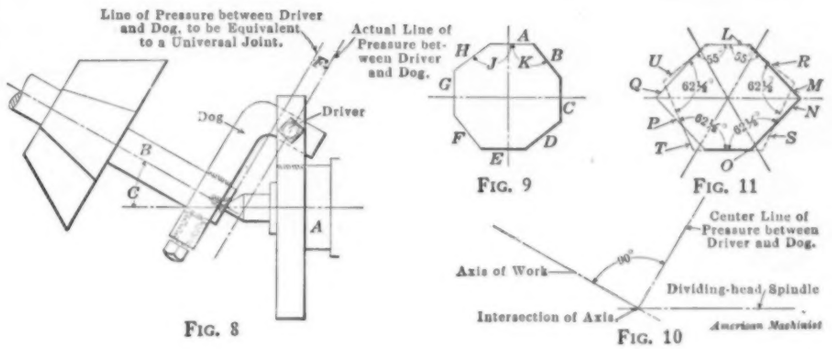
It may be noticed that the point where the two shafts *A* and *B* move with equal speeds is when *A* is moving from 47 degrees to 49 degrees inclusive, and it is at this position, of course, that *B* is its maximum amount behind *A*, this amount varying according to angle *C*. It also may be noticed that, when *B* continually loses during the first 46-degree movement of *A*, it has to make up this loss during the last 41 degrees of *A*; therefore, the latter part of its motion must be at a quicker rate than the beginning.

The movement of *B* in Fig. 2 is identical with *B* in Fig. 1, but there is an important difference between these two positions and that shown in Fig. 3. In Fig. 3 the fork joints have been turned through an angle of 90 degrees from those shown in Figs. 1 and 2, and therefore the movement of *B* would commence at the same speed as that at which *B* is moving at the time shown at the end of the table; viz., *B* commences its movement at a quicker rate than *A* and gradually loses. A point is reached at which *A* and *B* again move with approximately equal speeds, then when *A* has turned through 90 degrees from the position shown in Fig. 3, *B* has lost what it gained at the commencement of its movement and also has turned through 90 degrees. In either Figs. 1, 2 or 3 the total angular movement of *B* is identical with *A* at each 90-degree movement of *A*, starting from the positions shown; but at no other points do they agree in amount.

TWO JOINTS CORRECTLY ARRANGED

In Fig. 4 let *A*, *B* and *C* be the same as before, and angle *E* equal to angle *C*. Shaft *D* will then be parallel with shaft *A* and will revolve at all times with an angular velocity equal to that of *A*, neither gaining nor losing. This can be understood if the positions of the joint forks are considered, for the lower forks are in the same position as Fig. 1, while the upper forks are in the position shown in Fig. 3; therefore when *B* loses on *A*, *D* gains on *B* an equal amount. The position of shaft *D* in Fig. 5 does not alter the conditions, so long as *C* and *E* are equal.

If, however, the joint forks are set as in Fig. 6, then a very different action of shaft *D* takes place. In this it may be noticed that the two joints which act as the drivers; viz., *A* and the top end of *B*, are both the same as in Figs. 1 or 2; therefore, both driven shafts *B* and *D* will lose in speed at first, *D* losing twice as quickly as *B*. Afterward *D* will make up its loss at twice the speed of *B*, and be coincident with *A* in its total angular movement at each 90 degrees through which *A* has turned from zero. The movements of *D* in Fig. 7 are similar to *D* in Fig. 6, but in all these diagrams it must be understood that the axes of all the shafts lie in one plane in the other view from the one shown.



IRREGULARITY OF TAPER MILLING

APPLIED TO TAPER MILLING

That this peculiar movement is not clearly understood by all is evident when it is noticed that more than one miller now on the market has the feed to the table, knee, etc., transmitted through universal joints with the forks arranged as in Fig. 6. To consider another prac-

tical example take the case of a piece of taper work between centers in the miller, Fig. 8, in which the spindle of the dividing head remains parallel with the table and the tailstock center is raised to suit the angle of the work. For the sake of illustration this angle has purposely been made large.

Now, while it may not be clearly seen at first, this arrangement in the positions shown agrees with and is similar to the shafts in Fig. 1, the spindle *A* corresponding to the shaft *A*, the work *B* to the shaft *B*, and the angular movements of the spindle and work agree with the angular movements of *A* and *B*, Fig. 1. This assumes, of course, that the angle *C* is equal in both cases, and the dog on the work is *properly located*. It is obvious, therefore, that only at each 90-degree movement of *A*, does the movement of *B* coincide, and at every other portion of the rotation irregularity in the work occurs. Fig. 9 shows this irregularity, thus:

Faces *A* and *E*
Faces *B* and *F*
Faces *C* and *G*
Faces *D* and *H*

} Are parallel to each other, respectively;

Faces *C* and *G* are at right angles to *A* and *E*; but angles *J* and *K* are not equal, this difference becoming more marked as angle *C*, Fig. 8, increases.

Practical Conditions Even Worse

What was said about the dog being correctly located, referred to its position relative to the point of intersection of the axes of the spindle and work. The point on the dog against which the driver bears at all times should be along a line which is at right angles to the axis of the work, and which passes through the point of intersection of the two axes, as in Fig. 10. It is only when these conditions are fulfilled that the movement of *B* really follows the rule of the universal joint and in practice these conditions are rarely if ever obtained. If the dog has been set as in Fig. 8, then none of the ordinary rules or formulas hold good, the result being even greater irregularity. It is interesting to note the actual variations which occurred on a particular case under my own observation. To simplify matters a ball center was substituted for the ordinary cone center. Only in two positions; namely, at 180 and 360 degrees, were any of the faces parallel. This is well seen in Fig. 11, in which the full lines represent what should be the shape of the piece if the dog had been located to act as a universal joint, and the dotted lines the actual result obtained. From this it should be clear that work milled on centers thus can never be correct, the proper way being to tilt the dividing head and center to the angle required.

Example I

Figs. 1 and 2.

Tan A. Cosin C = Tan B.

Angular Rotation of Shaft *A*, Degrees	Angular Rotation of Shaft *B* in Same Time, Degrees and Minutes	Total Lag of Rotation of Shaft *B* in Degrees and Minutes	Change in Angular Lag of *B* During Preceding Movement of *A*
Col. 1	Col. 2	Col. 3	Col. 4
1	0 — 48	0 — 12	
			Increased Lag
2	1 — 36	0 — 24	0 — 12′
3	2 — 24	0 — 36	0 — 12′
4	3 — 12	0 — 48	0 — 12′
5	4 — 0	1 — 0	0 — 12′
6	4 — 48	1 — 12	0 — 12′
7	5 — 36	1 — 24	0 — 12′
8	6 — 24	1 — 36	0 — 12′
9	7 — 13	1 — 47	0 — 11′
10	8 — 2	1 — 58	0 — 11′
11	8 — 51	2 — 9	0 — 11′
12	9 — 40	2 — 20	0 — 11′
13	10 — 29	2 — 31	0 — 11′
14	11 — 18	2 — 42	0 — 11′
15	12 — 7	2 — 53	0 — 11′
16	12 — 56	3 — 4	0 — 11′
17	13 — 45	3 — 15	0 — 11′
18	14 — 34	3 — 26	0 — 11′
19	15 — 24	3 — 36	0 — 10′
20	16 — 14	3 — 46	0 — 10′
21	17 — 4	3 — 56	0 — 10′
22	17 — 54	4 — 6	0 — 10′
23	18 — 45	4 — 15	0 — 9′
24	19 — 36	4 — 24	0 — 9′
25	20 — 27	4 — 33	0 — 9′
26	21 — 18	4 — 42	0 — 9′
27	22 — 10	4 — 50	0 — 8′
28	23 — 2	4 — 58	0 — 8′
29	23 — 54	5 — 6	0 — 8′
30	24 — 47	5 — 13	0 — 7′
31	25 — 40	5 — 20	0 — 7′
32	26 — 33	5 — 27	0 — 7′
33	27 — 27	5 — 33	0 — 6′
34	28 — 21	5 — 39	0 — 6′
35	29 — 15	5 — 45	0 — 6′
36	30 — 10	5 — 50	0 — 5′
37	31 — 5	5 — 55	0 — 5′
38	32 — 0	6 — 0	0 — 5′
39	32 — 56	6 — 4	0 — 4′
40	33 — 52	6 — 8	0 — 4′
41	34 — 49	6 — 11	0 — 3′
42	35 — 46	6 — 14	0 — 3′
43	36 — 43	6 — 17	0 — 3′
44	37 — 41	6 — 19	0 — 2′
45	38 — 40	6 — 21	0 — 2′
46	39 — 38	6 — 22	0 — 1′
47	40 — 38	6 — 22	0 — 0′
48	41 — 38	6 — 22	0 — 0′
49	42 — 38	6 — 22	0 — 0′
			Decreased Lag
50	43 — 39	6 — 21	0 — 1′
51	44 — 40	6 — 20	0 — 1′
52	45 — 41	6 — 19	0 — 1′
53	46 — 43	6 — 17	0 — 2′
54	47 — 45	6 — 15	0 — 2′
55	48 — 48	6 — 12	0 — 3′
56	49 — 52	6 — 8	0 — 4′
57	50 — 56	6 — 4	0 — 4′
58	52 — 0	6 — 0	0 — 4′
59	53 — 5	5 — 55	0 — 5′
60	54 — 11	5 — 49	0 — 6′
61	55 — 17	5 — 43	0 — 6′
62	56 — 23	5 — 37	0 — 6′
63	57 — 30	5 — 30	0 — 7′
64	58 — 38	5 — 22	0 — 8′
65	59 — 46	5 — 14	0 — 8′
66	60 — 54	5 — 6	0 — 8′
67	62 — 3	4 — 57	0 — 9′
68	63 — 12	4 — 48	0 — 9′
69	64 — 22	4 — 38	0 — 10′
70	65 — 32	4 — 28	0 — 10′
71	66 — 43	4 — 17	0 — 11′
72	67 — 54	4 — 6	0 — 11′
73	69 — 5	3 — 55	0 — 11′
74	70 — 17	3 — 43	0 — 12′
75	71 — 29	3 — 31	0 — 12′
76	72 — 41	3 — 19	0 — 12′
77	73 — 54	3 — 6	0 — 13′
78	75 — 7	2 — 53	0 — 13′
79	76 — 20	2 — 40	0 — 13′
80	77 — 34	2 — 26	0 — 14′
81	78 — 48	2 — 12	0 — 14′
82	80 — 2	1 — 58	0 — 14′
83	81 — 16	1 — 44	0 — 14′
84	82 — 30	1 — 30	0 — 14′
85	83 — 45	1 — 15	0 — 15′
86	85 — 0	1 — 0	0 — 15′
87	86 — 15	0 — 45	0 — 15′
88	87 — 30	0 — 30	0 — 15′
89	88 — 45	0 — 15	0 — 15′
90	90 — 0	0 — 0	0 — 15′

TABLE OF ROTATIVE VARIATION DURING A QUARTER REVOLUTION OF A SINGLE UNIVERSAL JOINT ANGLE *C* BETWEEN SHAFTS 36 DEG., 52 MIN.

$A = 11° 45'$. *Tan* A $= 0.208$.

$C = 14° 32'$. *Cosin* $C = 0.968$.

Tan A Cosin C $= 0.208 \times 0.968 = 0.201344$.

$0.201344 =$ *Tan* $B = 11° 23'$.

This shows that *B* has lost:

$11° 45' - 11° 23' = 0° 22'$

Example II

Fig. 3.

Cotan A. Cosin C = Cotan B.

$A = 11° 45'$. *Cotan* $A = 4.80769$.

$C = 14° 32'$. *Cosin* $C = 0.968$

Cotan A Cosin C $= 4.80769 \times 0.968 =$ 4.65384.

$4.65384 =$ *Cotan* $B = 12° 08'$.

This shows that *B* has gained:

$12° 08' - 11° 45' = 0° 23'$.

Example III

Figs. 4 and 5.

Tan A. Cosin C = Tan B.

Cotan B. Cosin E = Cotan D.

$A = 11° 45'$.

$C = 14° 32'$.

Then, by example I, $B = 11° 23'$.

Cotan $11° 23' = 4.9669$.

Cosin $14° 32' = 0.968$.

$4.9669 \times 0.968 = 4.80795 =$ *Cotan* $D =$ $11° 45'$.

This shows that while shaft *B* lost $0° - 22'$ from *A*, shaft *D* gained that amount from *B*, and therefore the movements of *A* and *D* are equal.

Example IV

Figs. 6 and 7.

Tan A. Cosin C = Tan B.

Tan B. Cosin E = Tan D.

$A = 11° 45'$.

$C = 14° 32'$.

By example I, $B = 11° 23'$.

Tan $11° 23' = 0.20133$.

Cosin $14° 32' = 0.968$.

$0.20133 \times 0.968 = 0.19488 =$ *Tan* $D =$ $11° 02'$.

This shows a total loss of *D* from $A =$ $11° 45' - 11° 02' = 0° 43'$.

The growing number of firms engaged in the manufacture of steam turbines in Germany, and the pressure of competition, have induced these manufacturers, instead of devoting their time and capital to new inventions in that line, to concentrate their best energies exclusively to standardizing their output in order to reduce the cost of manufacture and to increase their profits. In the manufacture of steam turbines, as in many other lines of industry, it seems that the selling end of the business has outgrown the creative end; that is, the financial forces have repressed the technical forces of the concern. The German example so set can be profitably applied in other countries and fields.

A Toolroom Laying-out Machine

Editorial Correspondence

The adaptation of two standard types of machines to the requirements of laying out work, with a high degree of precision, in the tool room.

On page 963, Volume 30, Part 2, we published under the title "A Precision Drilling and Reaming Machine," a small bench drill press, especially arranged for use in the model-making department of the Burroughs Adding Machine Company. This machine has proved so useful that its special features have been given a much wider application, especially to tool-room work. Three additional machines of about the same size have been added to the equipment, and two more of much larger size. The new uses have suggested a new name, the machine being now called a "laying-out machine. Experience has suggested a few improvements, especially in the arrangement of the scales and verniers, which are the fundamental features of the machine.

Other high-class shops are now considering the installation of similar machines, and, in fact, a few have been made. For this reason we have thought it worth while to publish the latest construction of the Burroughs machines as a guide to others. The smaller machines shown in Fig. 1 were made by the Sigourney Tool Company, with suitable changes in the design of the tables, and the addition of a removable arm attached to the column and arranged to carry suitable bushes for drills and reamers; all clearly shown in the illustration. The scales and verniers were made by the Brown & Sharpe Manufacturing Company.

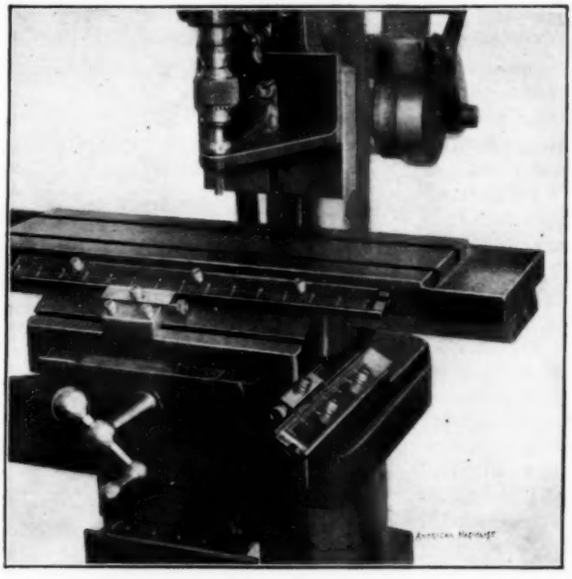


FIG. 1. SIGOURNEY VERTICAL DRILLER ARRANGED AS A TOOL-ROOM LAYING-OUT MACHINE

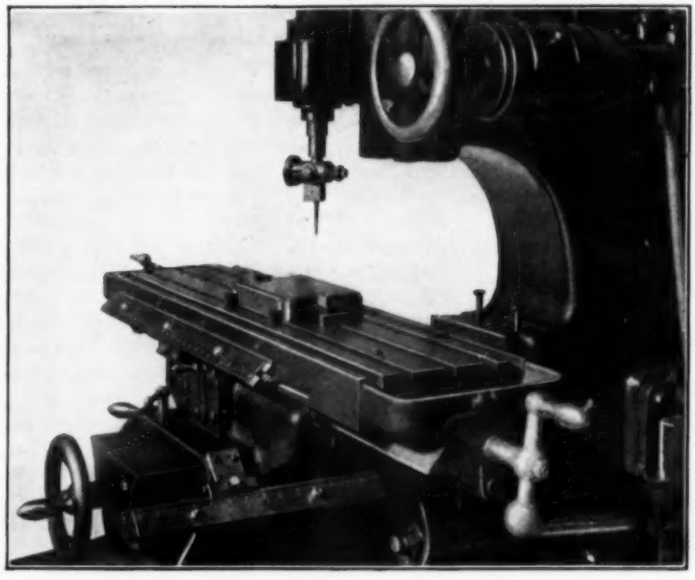


FIG. 2. BROWN & SHARPE VERTICAL SPINDLE MILLER ARRANGED AS A TOOL-ROOM LAYING-OUT MACHINE

THE ATTACHMENT OF THE SCALES AND VERNIERS

The new features relate chiefly to the method of attaching the scales and verniers, and to the design of the latter. It is by these instruments that the dimensions between jig holes are translated from the drawings to the work, the two scales giving the dimensions at right angles and with a degree of precision corresponding with that of high-class vernier readings. It will be observed that the scales are held in place by T-head bolts and nurled nuts, the heads of the bolts working in suitable slots in order to permit such adjustment of the scales as will make the initial readings zero, or at least at an even inch division, and thus avoid the necessity for repeated addition and subtraction of fractions in the translation of the dimensions from the drawings to the work. The verniers also are adjustable by nurled-head screws in order to permit the easy bringing of the zero of the verniers into agreement with the scales.

THE BASE LINE SYSTEM OF DIMENSIONS

The jig holes are laid out from base lines, and in the adaptation of the drawing system to the machine it has been found advantageous, in most cases, to have these lines pass through the center of one of the most important holes. This leads at once to measurements in both directions, and this makes it desirable to have the verniers read in both directions. To accomplish this the verniers are of twice the usual length with the zero in the middle.

One result of this method of locating the base lines is to simplify the setting of the scales. The hole through which the base lines pass is first drilled and reamed with respect to the surrounding metal and then, with the reamer still in the hole, the scales and verniers are set to zero and clamped in place.

The equipment of the machines with drills, reamers and bushings, is complete —a neat cabinet for these tools being provided below the table, as will be seen. Special fluted reamers are used, the special feature lying in the enlargement of the shanks to a diameter greater than that of the flutes, in order to adapt them to use with their own set of bushings.

A LARGER MACHINE

Fig. 2 shows one of the larger machines, which will be recognized as a Brown & Sharpe vertical-spindle miller, to which has been added a power down feed to the spindle for use in drilling and boring.

The scales and verniers are attached in the same positions and in the same manner as on the smaller machines. The work done on this machine being, however, much larger than that done on the small ones, an adjustable boring tool is substituted for the reamers, this boring tool being shown in position in the

spindle. Provision is, however, made for the use of bushings in connection with the preliminary drilling, by means of a removable arm, of which the planed seat and locating studs will be seen in front of the column and behind the table.

The last machine of the outfit is a Brown & Sharpe horizontal-spindle milling machine, which, however, in its special fittings, is so similar to the vertical machine shown that we have not thought it worth while to include an illustration of it.

There can be no doubt of the great usefulness and economy of these machines in the tool room, of which fact there can be, indeed, no better demonstration than the increase in the number of the machines at the Burroughs works from one to six.

"Taylorism"

This in both title and text is an editorial printed in the May 19 issue of *The Engineer* of London, and gives a British view of scientific management.

"Probably comparatively few of our readers know what Taylorism is, and yet at the moment it is convulsing the minds of American works managers. It is no new thing, but it has been brought suddenly into the light again by the publication of a book about it by its inventor. Ten years, or so, ago Mr. Taylor set about increasing the output of the Bethlehem works, and instead of tackling the machines which had already been speeded up, he "started in," as he himself would probably say, on the men. It was no ordinary case of hustling which he undertook. He did not go round and get rid of all the slow or incompetent men, and stimulate the remainder by methods known to managers, but instituted what has since come to be known in America as "motion study." He investigated every motion that a man or men had to perform in executing any given piece of work, from the lifting of it into a machine tool to the lifting out and depositing on the floor or truck. When he had got all his facts together, he drew up schedules which were known as route cards, which prescribed the exact order in which each operation, however small, was to be performed, and how long it was to take. Literally, he made a central office, the routing office, do all the thinking, and he endeavored as far as possible to make the men machines, only better than other machines for their particular jobs in that they could exercise a small modicum of intelligence—just about as much intelligence as a sensitive drill, which stops if too much work is put upon it, possesses. He succeeded, naturally in the face of a good deal of opposition, in working his plan, and has since extended it, while others—those who were present at the Birmingham meeting of the Institution of Mechanical Engineers will recall the long discourse on how to lay bricks economically—have applied it in other industries.

"There is much to be said for, but in our opinion and in that of a great many American managers, more to be said against Taylorism. Everyone knows that it is labor that costs money, and that economizing labor reduces production expenses more rapidly than any other practicable saving. But there are fair ways and unfair ways of diminishing labor costs, ways sportsmanlike and ways unsportsmanlike, ways humane and ways inhuman. We do not hesitate to say that Taylorism is inhuman. As far as possible it dehumanizes the man, for it endeavors to remove the only distinction that makes him better than a machine—his intelligence. We have always said, and it is now being generally admitted, that the modern machine tool leaves but little scope for intelligence. It is bad enough in that respect, but Mr. Taylor wants to go a step further and knock out the remaining fraction. We shall be told that works are not run as scholastic institutions, and that it is the business of the manager to study nothing but economical production. We shall regret the day when any such low standard of the duties of an employer is taken in English works. Routing is a sort of stultifying punishment that we might mete out to convicts engaged in building a breakwater, but for Heaven's sake let us leave the free man who works for us something on which to exercise his intelligence, something to make him higher than the machines he uses, and to give him a right still to call himself a man. We shall be told that this is sentiment. Well, why not? Sentiments before now have won great battles, and sentiments have saved great industries. Do Americans forget that it was sentiment that built the statue of Liberty at New York? We cannot get on without them, and one of the finest and best sentiments we have is the right everyone has to his own individuality. Mr. Taylor and those who think with him have, if they will permit us to say so, got themselves entangled between practicability and expediency. They have discovered by their precious motion studies that it is practicable to reduce labor by routing, but they have never considered whether it is expedient to route. In the few cases where Taylorism is employed it is successful, but we do not believe for one moment that the American working man as a whole has descended so so low a level that he will be content to be routed through life. We shall see.

"Mr. Taylor's system is naturally only possible in connection with some form of bonus system; it is inconceivable that men should work in the way they are expected to work—so hard and so mechanically that comparatively few are able to keep up to the standard—without receiving more than the normal pay. But to our mind it destroys all the good qualities of the premium or bonus system. The premium system is intended to stimulate a man to activity, both bodily and mentally. It requires not only that the man shall be active and steady at his work, but that he shall be continually alive to new methods of performing it that may be quicker than the old, and for any such improvements he can suggest he gets the reward of increased pay. The work is not all done by a human card index shut up in an office, and knowing nothing more of shop operations than he —or more properly it—can pick up from sheaves of schedules. It is not reached mechanically but intelligently, not by the intelligence of the slide rule but by human intelligence. Americans have talked a great deal about the suggestion box and other devices for encouraging the workman to take an active interest in his work. Suggestion boxes have never been fruitful, but at any rate the idea which inspired them was a human idea, which, we submit, cannot be said of Taylorism."

A Novel Method of Thread Cutting

By W. J. Spiro

The accompanying photograph of the pinion shaft of a Hendey shaper in use in the works of the Columbia Typewriter Manufacturing Company, illustrates a rather remarkable break.

The direction of revolution of this shaft is reversed at each end of the stroke, and mounted upon it are quills carrying the two driving pulleys. A hardened nut worked off the end of one of the quills and rested loosely on the

The Thread

shaft at *A*, gradually wearing away the metal of the latter, which was originally the full size of shaft, until the screw-thread shown at *A* had been formed. When the shaft finally twisted apart, this reduced section was only ¼ inch in diameter.

The screw-thread is as clean as if cut with a die, and suggests the possibility that some of your readers, with plenty of time at their command, may be able to utilize this novel method of cutting a thread between shoulders.

A New York daily calls attention to the following: One of the most marvelous things is the burning of a jet of hydrogen gas in liquid air. The smoke that arises from the combustion floats off in the air as pure snow. A flame burning brilliantly in the midst of a liquid, with snow given off for smoke!

Efficient Practical Management

By Eric M. Anderson

Suggestions for building an efficient organization in your own plant which can secure better results without disrupting the shop, and at a lower cost than by bringing in outside men who do not know your line of work.

No matter what paper we read, or what convention we may attend, Scientific Management (with a capital S and the accent on the Sigh) stares us out of countenance from glaring headlines, and arrests our attention by the startling statements until we are completely cured of any tendency to insomnia and can put ourselves to sleep by substituting visions of "gorilla-like laborers scientifically loading 47½ tons of pig iron on a car a day" for the proverbial flock of sheep going through a hole in the wall.

Nor are we restricted to the pig iron, we also have our choice of personally efficient girls scientifically inspecting bicycle balls; selected bricklayers scientifically laying bricks, or fancy shovelers operating with standardized scientific shovels with scientific rhythm, each shovel scientifically labeled with the specific gravity of the material it is to be used on and hung on a scientific hook.

What is the reason for all this fanfare of trumpets announcing the new creed? Do the scientific experts offer to pull through a struggling business and put it on its feet so that it can pay next month's gas bill or do they attack well rated established concerns paying big profits who can stand the drain?

Paying the Bills

It is no doubt true that scientific experts can point out a great many apparent as well as real defects and leaks in your management but stop and consider the cost of their diagnosis, their treatment and their prescriptions and whether they really do know more about it than you do.

If your factory equipment, systems, help and executive staff are so putrid that you are only getting from 20 to 50 per cent. of the return for your money that you ought to; if your profits are so large that you can afford it, turn the scientific experts loose and give them your pocket-book, they cannot help but improve matters in some way or other at a cost.

But remember that after a year or two you will have to wake up and scratch gravel to make brass tacks, gas engines or whatever your business may be and also to make both ends meet. For that is when the expert steps out and you step in. The statements of a perfected, 100 per cent. efficiency, scientific system that perpetuates itself is as much of a myth as the statement that the Keeley motor can propel itself. Look up past records for yourself.

Train Your Own Staff

But if you are really interested in the improvement of your business, get your own ear to the ground. If you don't know your own business better than an unacquainted scientific expert, learn it. If your personal duties are too large to attend to the improvement of your business or factory, pick out a loyal capable member of your staff, appoint him your head efficiency man, gradually relieve him of routine duties, make a contract with him if necessary in order to hold him, give him advice when he wants it, encouragement when he needs it and an incentive to give you his best efforts. Let him visit other concerns manufacturing on an efficient basis to study their methods; there are plenty who are efficient practically and who are glad to extend the courtesy.

Supply him with and let him study while you pay him, standard and scientific books on factory systems and management. A good practical man trained in your business can glean a great many ideas from the books that may be used with considerable advantage if intelligently modified.

Come to a realization that if your factory is inefficient, it is directly or indirectly up to you. You have been too careful about small leaks, while the large leaks have been taking care of themselves. Loosen up on your restrictions which you have placed on so called non-productive or expense help (you would have too, oh how much, with scientific management).

Take your men who are best on productive jobs, who stand so high in their particular line that you feel you cannot replace them and if they are otherwise capable, promote them as you need them to the non-productive (?) job on your efficiency staff. Let them instruct and supervise other help in that line.

Supply Necessary Tools

Supply your efficiency staff with stop watches, slide rules and other modern appliances that will increase their own efficiency. Supply them with the coöperation of a competent designing staff under the general supervision of your head efficiency man. Supply them with the aid of such clerical systems as are necessary to keep proper records of output, cost, expenses, results of improvements and to help them as required in their work.

The stop watches you can buy ready made. The department for designing improved and more economically manufactured products, better machines, and tools and the clerical system you will have to train and build up slowly to meet your more efficient requirements.

You probably have already systems as above, more or less inefficient because of a lack of team work. Make your efficiency staff the connecting link between the various branches of your business and delegate to your head efficiency man sufficient authority to obtain the coöperation of every department upon which its efficiency depends (which means every department).

Have all questions of any magnitude carefully investigated and fully reported with data and estimates to you in writing, for consideration before making any radical change and you will thus avoid dangerous and costly flare-backs often caused by hasty or premature decision.

Direct your efficiency force at ferreting out and stopping the large leaks and you will find that the small leaks will incidentally keep cropping to the surface, demanding notice. Cure the large leaks by necessary changes and judicial expense and you will find that many of the small leaks will disappear with them. Let your whole factory know that you are anxious to spend money to save money where the return is sure, and that your head efficiency man is waiting to hear from them. Suggestions will then come in from the people who know, which will often show ways to save expense in production or improve the product which would take six or eight months' ferreting to disclose.

The Pivotal Point

Remember, and have your efficiency man remember, that every manufacturing proposition has a "pivotal" point; that is a point where expense and result are so balanced that if the result is improved or the output thereof increased beyond this point, the expense will be increased in a greater ratio, thereby causing a loss. Also, that any attempt to decrease the expense below what is required at this point will cause a decrease in a greater ratio in the output or the quality of the product, likewise causing a loss. In other words at the pivot point, the result is good enough in quality and you are receiving the best return for your money. Every factory has many jobs being operated at a wide divergence from

this "pivotal" point due to various causes, such as close-fistedness about legitimate expense, lack of coöperation, discouraging employees of different ranks from complaining or suggesting, giving a big job to a small man, etc.

Illustrations of these jobs are cases where the tools are so primitive as to make the cost of production so excessively high that the installation of proper equipment would pay for itself in a short time. Another, the reverse condition, where there are expensive, complicated tools with a high rate of output, but whose high initial cost, interest on the investment, high power consumption and upkeep render the actual total cost of production much higher than with a less productive equipment.

Another illustration is to give an average workman a complicated job of fine assembling or mechanical work to do without supplying him with efficient and systematic supervision and laying out a proper series of steps for him by which the work is to be performed.

Illustrations without end from everyday conditions in most any shop, particularly some that have been most scientifically systematized, could be given would space permit, applying not only to straight shop work, but to clerical systems, inspection systems, designing work, to the organization as a whole, and to some kinds of scientific efficiency work.

The recognition of the proximity of this pivotal point is the true basis of efficient practical management and cannot be located by the cure-all scientific expert on account of his own personal inefficiency in your line of business and his lack of incentive other than to get as big pay from you as he can, while he can.

Build Your Own Organization

Cultivate your own men; treat them so you could not drive them away, pick out men from your force. You surely must have them. Don't think that they have not the proper requisites to help you build up an efficient practical management because they haven't given any striking examples of their ability in this line. You probably have never given them a chance or an incentive. Appreciation is sometimes a bigger incentive than money.

If you absolutely have not the right material for efficiency work in your own plant don't try to buy it at so much a yard over the scientific counter. You are very apt to get short measure. But reach out and get *efficient practical* men who have proved their worth in your own or similar lines and who are looking for some firm to make it worth their while to give the very best that is in them. Get them and keep them, and above all discourage any efforts to first disorganize and then reorganize your business; it is disastrous and costly.

By gradually increasing the scope of your efficiency staff and resultantly the efficiency of your shop by practical methods, it will eventually and painlessly become reorganized wherever necessary and the profits will show a gradual actual increase and not a sudden downward curve; and the profits will be real, and not paper ones that do not materialize at the end of the year.

Don't let anyone whisper to your ear that efficient practical management means giving a stop watch to a clerk and sending him into the shop. The stop watch may become a dangerous and sometimes a pretty expensive article. An efficient practical management would as soon put it in the hands of the above mentioned clerk to time a job for them, as they would put a loaded hairtrigger gun in the hands of a six-year old.

A man to make a proper timing on any work in order to be fair to both employer and workman, should thoroughly know and be expert in the work he is timing. Otherwise if the workman is half way clever, and they usually are, he can scientifically fool the most scientific expert and get away with a fat price as a result.

On the other hand the expert can, by making abstruse calculations and in sufficient allowances for oiling machines, grinding tools, adjusting for wear, proper clamping work, etc., set a price that is unprofitable for the employer, and unfair to the workman and set the whole department by the ears and makes them bristle every time afterward that they see a stop watch even if in the hands of a man who knows his business.

Then again, an efficient practical man, (there are lots left) can make a timing and set a price in half an hour or so on a short operation which would require scientific motion studies for a week without arriving half as close to the pivotal point in setting their price and deciding how to do the work.

Table of Board Feet in Pieces 1 to 24 Inches Wide Up to 24 Feet Long

By B. E. Winslow

The table herewith shows the board feet contained in planks of a given width and length. This table is of use especially to the patternmaker but may be of value to anyone having to make calculations in board measure.

When we read of the "bends," or caisson disease, and remember that a pressure of about 40 pounds per square inch is the greatest under which men can work —and that only for an extremely short time; it is of interest to note that the pressure in the ocean at a depth of five miles is just about 5¼ tons per square inch. It would seem that the "monsters of the deep," living down there, have some powers of resistance far in excess of mere man.

Width of Board in Inches	Length of Board in Feet																							
	1′	2′	3′	4′	5′	6′	7′	8′	9′	10′	11′	12′	13′	14′	15′	16′	17′	18′	19′	20′	21′	22′	23′	24′
1″	1/12	1/6	1/4	1/3	5/12	1/2	7/12	2/3	3/4	5/6	11/12	1	1 1/12	1 1/6	1 1/4	1 1/3	1 5/12	1 1/2	1 7/12	1 2/3	1 3/4	1 5/6	1 11/12	2
2″	1/6	1/3	1/2	2/3	5/6	1	1 1/6	1 1/3	1 1/2	1 2/3	1 5/6	2	2 1/6	2 1/3	2 1/2	2 2/3	2 5/6	3	3 1/6	3 1/3	3 1/2	3 2/3	3 5/6	4
3″	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5	5 1/4	5 1/2	5 3/4	6
4″	1/3	2/3	1	1 1/3	1 2/3	2	2 1/3	2 2/3	3	3 1/3	3 2/3	4	4 1/3	4 2/3	5	5 1/3	5 2/3	6	6 1/3	6 2/3	7	7 1/3	7 2/3	8
5″	5/12	5/6	1 1/4	1 2/3	2 1/12	2 1/2	2 11/12	3 1/3	3 3/4	4 1/6	4 7/12	5	5 5/12	5 5/6	6 1/4	6 2/3	7 1/12	7 1/2	7 11/12	8 1/3	8 3/4	9 1/6	9 7/12	10
6″	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	10 1/2	11	11 1/2	12
7″	7/12	1 1/6	1 3/4	2 1/3	2 11/12	3 1/2	4 1/12	4 2/3	5 1/4	5 5/6	6 5/12	7	7 7/12	8 1/6	8 3/4	9 1/3	9 11/12	10 1/2	11 1/12	11 2/3	12 1/4	12 5/6	13 5/12	14
8″	2/3	1 1/3	2	2 2/3	3 1/3	4	4 2/3	5 1/3	6	6 2/3	7 1/3	8	8 2/3	9 1/3	10	10 2/3	11 1/3	12	12 2/3	13 1/3	14	14 2/3	15 1/3	16
9″	3/4	1 1/2	2 1/4	3	3 3/4	4 1/2	5 1/4	6	6 3/4	7 1/2	8 1/4	9	9 3/4	10 1/2	11 1/4	12	12 3/4	13 1/2	14 1/4	15	15 3/4	16 1/2	17 1/4	18
10″	5/6	1 2/3	2 1/2	3 1/3	4 1/6	5	5 5/6	6 2/3	7 1/2	8 1/3	9 1/6	10	10 5/6	11 2/3	12 1/2	13 1/3	14 1/6	15	15 5/6	16 2/3	17 1/2	18 1/3	19 1/6	20
11″	11/12	1 5/6	2 3/4	3 2/3	4 7/12	5 1/2	6 5/12	7 1/3	8 1/4	9 1/6	10 1/12	11	11 11/12	12 5/6	13 3/4	14 2/3	15 7/12	16 1/2	17 5/12	18 1/3	19 1/4	20 1/6	21 1/12	22
12″	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
13″	1 1/12	2 1/6	3 1/4	4 1/3	5 5/12	6 1/2	7 7/12	8 2/3	9 3/4	10 5/6	11 11/12	13	14 1/12	15 1/6	16 1/4	17 1/3	18 5/12	19 1/2	20 7/12	21 2/3	22 3/4	23 5/6	24 11/12	26
14″	1 1/6	2 1/3	3 1/2	4 2/3	5 5/6	7	8 1/6	9 1/3	10 1/2	11 2/3	12 5/6	14	15 1/6	16 1/3	17 1/2	18 2/3	19 5/6	21	22 1/6	23 1/3	24 1/2	25 2/3	26 5/6	28
15″	1 1/4	2 1/2	3 3/4	5	6 1/4	7 1/2	8 3/4	10	11 1/4	12 1/2	13 3/4	15	16 1/4	17 1/2	18 3/4	20	21 1/4	22 1/2	23 3/4	25	26 1/4	27 1/2	28 3/4	30
16″	1 1/3	2 2/3	4	5 1/3	6 2/3	8	9 1/3	10 2/3	12	13 1/3	14 2/3	16	17 1/3	18 2/3	20	21 1/3	22 2/3	24	25 1/3	26 2/3	28	29 1/3	30 2/3	32
17″	1 5/12	2 5/6	4 1/4	5 2/3	7 1/12	8 1/2	9 11/12	11 1/3	12 3/4	14 1/6	15 7/12	17	18 5/12	19 5/6	21 1/4	22 2/3	24 1/12	25 1/2	26 11/12	28 1/3	29 3/4	31 1/6	32 7/12	34
18″	1 1/2	3	4 1/2	6	7 1/2	9	10 1/2	12	13 1/2	15	16 1/2	18	19 1/2	21	22 1/2	24	25 1/2	27	28 1/2	30	31 1/2	33	34 1/2	36
19″	1 7/12	3 1/6	4 3/4	6 1/3	7 11/12	9 1/2	11 5/12	12 2/3	14 1/4	15 5/6	17 5/12	19	20 7/12	22 1/6	23 3/4	25 1/3	26 11/12	28 1/2	30 1/12	31 2/3	33 1/4	34 5/6	36 5/12	38
20″	1 2/3	3 1/3	5	6 2/3	8 1/3	10	11 2/3	13 1/3	15	16 2/3	18 1/3	20	21 2/3	23 1/3	25	26 2/3	28 1/3	30	31 2/3	33 1/3	35	36 2/3	38 1/3	40
21″	1 3/4	3 1/2	5 1/4	7	8 3/4	10 1/2	12 1/4	14	15 3/4	17 1/2	19 1/4	21	22 3/4	24 1/2	26 1/4	28	29 3/4	31 1/2	33 1/4	35	36 3/4	38 1/2	40 1/4	42
22″	1 5/6	3 2/3	5 1/2	7 1/3	9 1/6	11	12 5/6	14 2/3	16 1/2	18 1/3	20 1/6	22	23 5/6	25 2/3	27 1/2	29 1/3	31 1/6	33	34 5/6	36 2/3	38 1/2	40 1/3	42 1/6	44
23″	1 11/12	3 5/6	5 3/4	7 2/3	9 7/12	11 1/2	13 5/12	15 1/3	17 1/4	19 1/6	21 1/12	23	24 11/12	26 5/6	28 3/4	30 2/3	32 7/12	34 1/2	36 5/12	38 1/3	40 1/4	42 1/6	44 1/12	46
24″	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48

TABLE GIVES BOARD FEET IN AN INCH THICK PLANK. FOR OTHER THICKNESSES MULTIPLY BY THICKNESS IN INCHES

Cutting Off Hollow Bored Cores

By J. Forkardt

This tool is applicable to all kinds of steel, saves stock and simplifies construction. It is used on the same machine that is used in boring the cores. The feed is obtained through small steel ropes.

Cylindrical hollow steel bodies with bottoms can be made out of the solid in the following ways:

1. By removing all of the material to complete the hollow; beginning with a drill or boring tool of small diameter and following with larger ones of graded sizes. When the inner diameter and length of the bore are large, this method is tedious and therefore expensive.

2. By boring down the whole outer length of the work with a hollow boring tool, and afterward forging and welding on the bottom. This method, however, is possible, only in special cases; that is, only with certain dimensions, materials, and ultimate purposes.

3. By boring out a core down to the inside of the bottom, undercutting the core with a special tool, and breaking it off with a wedge thrust into the ring-shaped hollow at the top, Fig. 1. This method is applicable to all kinds of steel. It is especially advantageous, when valuable material is used, in saving the stock in the core, and, where the interior pressures are to be high, in simplifying the construction and reducing the cost.

The Tool for Undercutting

Fig. 3 shows a cutting-off tool for hollow core borings. The construction shown

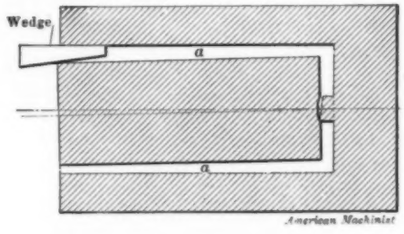


Fig. 1. Breaking Off a Core by Means of a Wedge, after it Has Been Undercut

in the figure is a special one arising from the following conditions of design:

(1) The intermediate space *a* in Fig. 1 must be as small as possible, to minimize the quantity of material cut away in chips, and thus save stock and time.

(2) The undercutting of the core must be as near as possible to the end of the bore to save after-work on the bottom.

(3) The stem to be broken off must be very small, to facilitate breaking and to prevent a form of fracture that might injure the bottom.

(4) It must be possible to draw the cutter out of the hole in case it sticks fast, due to breaking or any other cause.

The body of the cutting-off tool, Fig. 2, is made of steel with a strength of about 60 to 70 kilograms per square millimeter (80,000 to 100,000 pounds per square inch). A steel bolt is screwed in a milled eye and on this bolt a tool holder *b* is pivoted, curved in conformity with the bore. The cutter *c*, of high-speed steel, is dovetailed into the holder. In the end of the holder there is a hole in which there are fastened two cords of very high-grade steel wire with loose ends. The cords are led out through opposite eyelets in the tool body parallel to its axis. The cord that is entirely visible in Fig. 2 serves to feed the cutter under; the thinner cord, only a small part of which is seen here, may be used to pull the cutter out of the undercut. The body of the tool is centered in the bore that has been made, by four hardwood blocks *d* dovetailed into the periphery of the body.

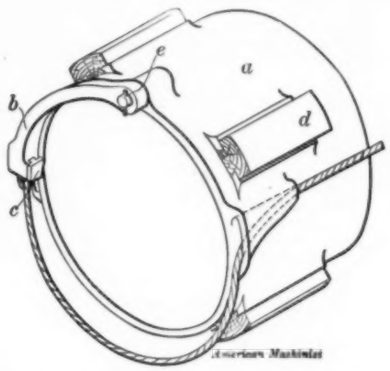


Fig. 2. Cutting-off Tool for Undercutting Cores

The following specifications apply to the construction of this appliance under the conditions of the present case:

(a) In consequence of the compact form of the toolholder *b* the shell of the tool body *a* may be quite thin.

(b) The cutting-off cutter *c* is placed on the extreme end of the holder.

(c) The edge of the cutting-off cutter lies at the distance of a quadrant from the pivot.

(d) The toolholder *b* is held on its pivot by a copper pin *e* which may be sheared off by a forcible pulling out of the tool body.

Using the Cutting-off Tool

The cutting off of the core is performed on the same machine that is used for the boring, Fig. 3. The cutting-off tool is attached in the same manner as the hollow boring tool by means of threads on the hollow boring bar. The cord *f*, in Fig. 3, used to feed in the cutting-off tool, is led over the pulley *g* and wound on the drum *i* which is driven by the feed rod *h*. For undercutting the core, the axial feed of the hollow boring bar must, of course, be disconnected.

The cutting lubricant, composed of a mixture of water with a cutting oil soluble in water is forced under high pressure through the boring bar to wash away the chips. It is of great importance to grind the cutter so that the chips do not roll off as long shavings but break into small pieces.

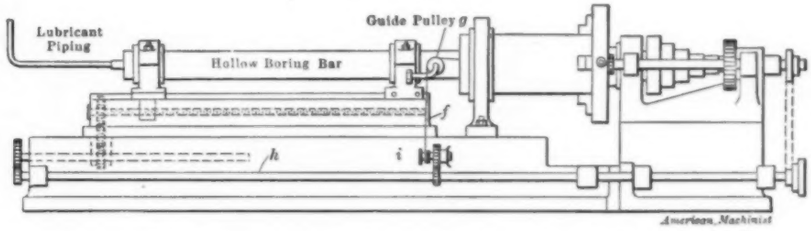


Fig. 3. Machine for Boring and Cutting Off Cores

The following case of how a hot bearing was avoided by the use of sheet lead may be of interest:

Some time ago one of the journals of a heavy locomotive gave considerable trouble by continually running hot. It was assumed that the trouble was caused by an overhard brass bearing in the box. The box was therefore raised off the journal about ¼ inch, and a piece of thin sheet lead was inserted between the shaft and the bearing surface of the brass bearing. The lead was thus worked into the pores of the brass and no further trouble was experienced.

A Simple Time and Material System

By Thomas J. Walsh

For those who desire to eliminate the unnecessary recording of time spent, and material used on an order, the simple system of which the forms below are self explanatory, is respectfully submitted.

Form 1—A daily time card for each workman, subdivided by perforations into three job cards. The card may be arranged for more subdivisions if required. fashion and can be arranged in any desired manner. Guide cards for each part number, showing cost of previous lot, will serve as a comparative record, and by this means any deviation from standard times of operation may be investigated immediately on the completion of each part, or number of parts.

This arrangement of cards will also serve as an automatic reporter of the progress of the work on an order; an indispensable adjunct to an efficient routing system, it being possible to locate any part of a machine in work, and the workman working thereon.

Date 4-25-11 | Order No. 778 | Key No. 310 | Name C. Duffy | Class 6

Time Finished	Time Elapsed	Rate	Cost
8[45]	1[3]	30	.53

O. K. *J. K. L.* Foreman.

Date 4-25-11 | Order No. 222 | Part No. 74 | Key No. | Name | Class

Time Finished	Time Elapsed	Rate	Cost
3[30]	6[1]	30	1.87

O. K. *J. K. L.* Foreman.

Date 4-25-11 | Order No. 1964 | Part No. 324 | Key No. | Name | Class

Time Tinished	Time Elapsed	Rate	Cott
5[30]	2	30	.60

O. K. Foreman.

7.00	10
.15	9[3]
.30	9[2]
.45	9[1]
8.00	9
.15	8[3]
.30	8[2]
.45	8[1]
9.00	8
.15	7[3]
.30	7[2]
.45	7[1]
10.00	7
.15	6[3]
.30	6[2]
.45	6[1]
11.00	6
.30	5[3]
.45	5[2]
.45	5[1]
12.00	5
.15	5
.30	5
.45	4[3]
1.00	4[2]
.15	4[1]
.30	4
.45	3[3]
2.00	3[2]
.15	3[1]
.30	3
.45	2[3]
3.00	2[2]
.15	2[1]
.30	2
.45	1[3]
4.00	1[2]
.15	1[1]
.30	1

Order Nos. Key No. 310 Name C. Duffy Total Time 10

FORM 1

I have, however, found that three was the *average* number of jobs, per day *worked on by one man,* in several large shops.

The foreman is required to fill in the order number, part, class and time finished. So many objections have been made against the foreman doing clerical work, that the card was designed to overcome those objections, at the same time meeting requirements that permitted filing and classifying as hereinafter explained.

The time cards, at the end of the day, are sent to the office, where the total time is entered on the payroll. They are then extended, and the job cards detached at the perforated lines. These job cards are then filed, card index

Form 2—The material card is at once the foreman's requisition, and the record of stock furnished. It is delivered by the foreman to stock clerk, for material furnished, who extends the cost; the card is then filed with the job cards above mentioned.

Form 3—The workman's rate card is provided also with the extensions up to ten hours, thus practically reducing the looking up of the workman's rate and the extension of the cost to one operation.

Pro. No... Order No.. Part No.. Date...

Furnish following material for above order No.:

Quantity	Material	Size	Weight	Value

FORM 2

Name *C. Vuffy* Key No. 310 Rate 30

Hr.	$	Hr.	$	Hr.	$	Hr.	$	Hr.	$
[1]	0 08	2[1]	0 68	4[1]	1 28	6[1]	1 88	8[1]	2 48
[2]	0 15	[2]	0 75	[2]	1 35	[2]	1 95	[2]	2 55
[3]	0 23	[3]	0 83	[3]	1 43	[3]	2 03	[3]	2 63
1	0 30	3	0 90	5	1 50	7	2 10	9	2 70
[1]	0 38	[1]	0 98	[1]	1 58	[1]	2 18	[1]	2 78
[2]	0 45	[2]	1 05	[2]	1 65	[2]	2 25	[2]	2 85
[3]	0 53	[3]	1 13	[3]	1 73	[3]	2 33	[3]	2 93
2	0 60	4	1 20	6	1 80	8	2 40	10	3 00

FORM 3

It may be stated in conclusion that the strip at left of time card, will be used as the pay roll record; the figures at the right are designed to facilitate the ascertaining of the elapsed time on each order.

Machine Tools

By C. W. Crawford

Referring to your editorial, page 897, regarding "Machine Tools," in which you have conceded that the term "machine tool" is ungrammatical, which is true in a technical sense, but the words fit the purpose so well that it would be unsatisfactory to everybody to change it.

As an improvement I would suggest a hyphen between the words, making them both nouns and both correct, and the words machine tools in small type would obviously come to mean the tools used in the machine.

Tin plate makes a new record in two or three important particulars in the commerce of the United States for the fiscal year just ended. The imports are lower than in any year since the record of its importation was begun, the outward movement of American tin plate was larger than ever before, and the shipment of domestic tin plate out of continental United States for the first time exceeded the imports of froeign tin plate. For the first time since the records of tin plate were published by the Bureau of Statistics of the Department of Commerce and Labor, the imports of tin plate will probably fall under the 100 million pound line. The first record of production of domestic tin plate shows a production of 2¼ million pounds for the last six months of 1891. During 1892, the first full year for which figures are available, the production amounted to 4⅔ million pounds, and from that time on the production increased rapidly, passing the 500 million mark in 1897 and the 1 billion mark in 1903, the actual figures being 575 and 1075 million pounds respectively. In 1906 the production amounted to 1294 million pounds, and in 1909, the last year for which figures are available, the production amounted to 1371 million pounds.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Blanketed Patents

A recent popular line of invention has come to my attention which illustrates a common pitfall in the inventor's path.

About everyone with a mechanical bent has observed that an automobile in turning a corner at night throws the light from its headlights upon the bushes rather than the road. We have wondered why the auto manufacturers have not rigged up a scheme to connect the headlights with the steering gear so that they would look around the corner instead of into the woods.

This question occurred to the writer a good many months ago, before he knew whether or not there were any such devices on the market.

For the past six months or so from one to half a dozen of these automatically regulated headlights have been patented each month. The claims have got down so fine that the recent applicants are nearly driven to including the chauffeur in order to get a claim. The headlights are connected with the steering gear in this way, and the other way, and are provided with connecting links, hung at all angles, supplied with adjustments and turnbuckles, and rotated by levers, gears and chain drives. The headlights can both look around the corner, one can look straight ahead and the other around the corner, one can wink while the other stares, or if desired they will obligingly look cross-eyed. They are adapted for automobiles, street cars and locomotives.

Now, one inquires, why are not most of the automobiles on the market equipped with these devices? That is perhaps where the pitfall gathers its harvest of victims. Nearly all of the inventions of these patents cannot be used by their owners for some time to come.

It is not an uncommon story. Back in 1898 W. S. Schuyler applied for a patent on a motor-vehicle which issued on May 9, 1899. It has five more years to run. The first claim reads as follows:

"In a vehicle, the combination set forth of a support; a headlight pivoted to the support; an operating-arm having one end attached to the headlight and the other end attached to the running-gears of the vehicle and adapted to turn the headlight to correspond with the line of travel of the vehicle."

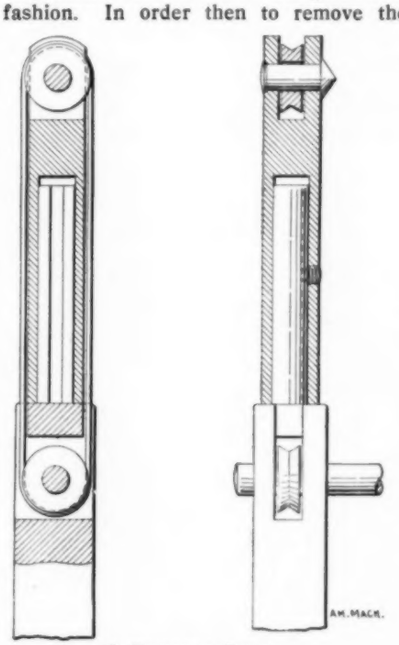
Possibly some of the many inventors in this line were aware of this basic patent and only patented their own inventions with the intention of selling to the individual or company owning the basic patent, or with the intention of waiting for its expiration before entering the market. It is pretty certain to be true, however, that very few were so informed and that nearly all became aware of the existence of the basic patent only after the filing of their case or after an attempt was made to sell the granted patent.

Patenting an invention without making a search is often like diving into the river without first ascertaining how deep the water is.

Lowell, Mass. IRVING D. KIMBALL.

A Burring Device

In the accompanying line cut I present a burring device for removing the inside burs of bored bushings. My firm makes brass bushings which, for better lubrication, are drilled through sieve-fashion. In order then to remove the bur, which comes through in drilling, I have constructed this little device, which works very nicely. It can be used in any drilling machine. The piece of rectangular section is clamped in the vise and the spindle in a drill chuck. The two little wheels are connected with a belt. In order that the belt shall always be tight, the upper part is adjustable. The cutting tool used is an ordinary countersink.



A BURRING DEVICE

Berlin. MAX JAENSCH.

Methods of Paying Labor

A few years ago there were only two systems of paying for labor, day work and piece work. An employer chose one or the other, according as he preferred to drive or lead his help. No other systems were needed nor could they have been used, because the average workman was in the condition of the Irishman, who refused an offer of a dollar and a quarter a day on the ground that he preferred "a hundred days a hundred dollars." Simplicity appealed to him.

Today other schemes of payment are in vogue, in fact a new one is invented nearly every day, the latest to appear is "gang piece work." Whether this will have any longer run than the hobble skirt and just what system will be the worst one when this is abolished, is hard to tell.

The scheme is to pay a gang of men a piece rate for everything that goes through their hands without being spoiled. Instead of throwing the money up in the air on pay day and letting the gang fight for it, it is divided by the employer in certain arbitrary portions. Just what the provision is for throwing out the drones from any gang I do not know, but I presume they are allowed to hate themselves to death.

Why, at this late day, anyone should bring forth the community idea of working, is difficult to see. This has been tried out through all history with pretty uniformly disastrous results, the only successes happening when the community which thought it was living in common was really under the heel of a tyrant. In this instance the proprietor must play tyrant, in which case it seems hard to say just why he needs any system of paying wages.

There is in this scheme just one gleam of sense—the idea of team work. Most systems of payment are aimed at the individual and team work is left to be supplied with a rod of iron from up above.

Some system that puts its chief emphasis on quantity and quality of individual

work and then gives an additional reward to those members of a gang who do help to make the work of the whole gang better, would be most acceptable. Of course, we get this now in a gang of men on day work under a really competent foreman, who pays his men according to their deserts and who is not slow to tell them why they do not get more money.

There are those who believe that every man ought to be glad to work at his best for the pure love of work. Even they ought to admit that very few can really love to perform one little measly operation on million after million of pieces, all alike and belonging to some other man, who rides in an automobile instead of a trolley car. Probably the vast majority of men would work and do work for the love of what they can produce by their work, but if that is solely money, then the best system of payment from their point of view is that which gives them the most money for their individual work, rather than that which divides the money between the members of a gang on a percentage basis.

Worcester, Mass. ENTROPY.

Table for Advance of Cutoff Tools

It often requires extra time and trouble in screw-machine work to stop in the midst of a cam layout and figure the distance a cutoff tool must travel for the beveled edge to pass the center of the work as in Fig. 1.

A table is shown herewith which gives this distance for the different widths and angles of cutters used in automatic and hand screw-machine work.

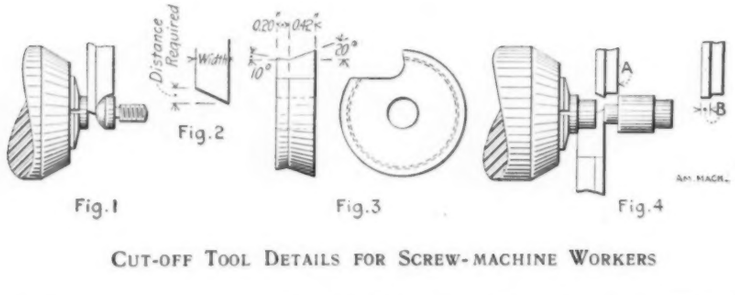
In this table the distance required and the width of the cutoff tool are given, as illustrated in Fig. 2.

The 20-degree angle is used very often for a cutoff tool, as shown in Fig. 3, and this cutter is necessary on very small diameter wire.

The form tool at *A* in Fig. 4 is often used to form and round the corner of a roll and should have the 20-degree angle.

If this cut is made as shown at *B*, it will form the stock to such small diameter that the cutoff tool will break off the piece before it will cut it off.

Harrisburg, Penn. S. N. BACON.



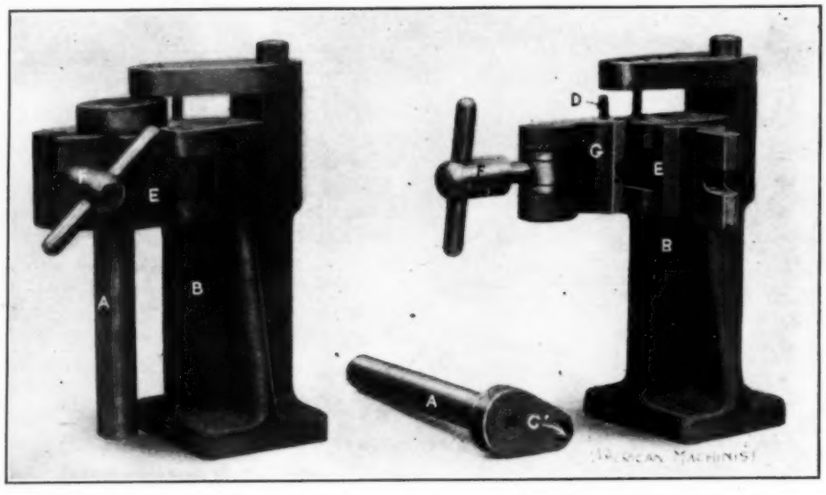
CUT-OFF TOOL DETAILS FOR SCREW-MACHINE WORKERS

10 DEGREES	15 DEGREES		20 DEGREES	
Distance Required	Distance Required	Width of Cut-off Tool	Distance Required	Width of Cut-off Tool
0 0071	0.0107	0.040	0.32	0.0116
0 0079	0.0121	0.045	0.040	0.0146
0.0088	0.0134	0.050	0.045	0.0164
0.0106	0.0161	0.060	0.050	0.0182
0.0109	0.0166	0.062	0.055	0.0200
0.0123	0.0189	0.070	0.062	0.0226
0.0141	0.0214	0.080	0.070	0.0255
0.0159	0.0241	0.090	0.080	0.0291
0.0164	0 0249	0.093	0.085	0.0309
0.0176	0.0268	0.100	0.090	0.0328
0.0212	0.0322	0.120	0.093	0.0330
0.0220	0.0335	0.125	0.100	0.0364
0.0264	0.0402	0.150	0.120	0.0437
0.0275	0.0418	0.156	0.125	0.0455

TABLE FOR ADVANCE OF SCREW MACHINE CUT-OFF TOOL

Drilling Jig for Rock Arm Shafts

Unfortunately I cannot show the jigs formerly used to drill the rock-arm shafts shown at *A* but with them the average time on drilling the hole *C* was 3.6 minutes each. The jigs *B* are clamped four at a time on the table of a four-spindle drill press with independent automatic feed for each spindle. The stationary V shown at *G* is part of the casting *B*. The stem of the rock arm shaft is put in this V and the clamping V *E* swung against it. The swinging bolt *F* is turned into the slot in *E* and while the nut is being tightened the web of the rock arm is held against the locating stop *D*. With this method the arms are drilled at the rate of one every 36 seconds.



DRILL JIG FOR ROCK-ARM SHAFTS

New York, E. A. DIXIE.

Knowing Too Much

Is there such a thing as knowing too much?

A question has recently come to my notice that seems to impress me with the idea that there are a lot of things we want to know that we do not seem to know.

We recently had to remove a piston rod from a steam hammer. It was a very stubborn job and only yielded to eight blows of a ton and a half battering ram. We immediately began wondering why the eighth blow started it when it was no greater than the first blow and then started to figure out the blow delivered.

After determining the force of the blow mathematically, we found that the ten men pushed with their whole force to accelerate the ram but we are now wondering what earthly good could possibly come from knowing the force of this blow.

Syracuse, N. Y. JOHN E. SWEET.

A Coring Cutter

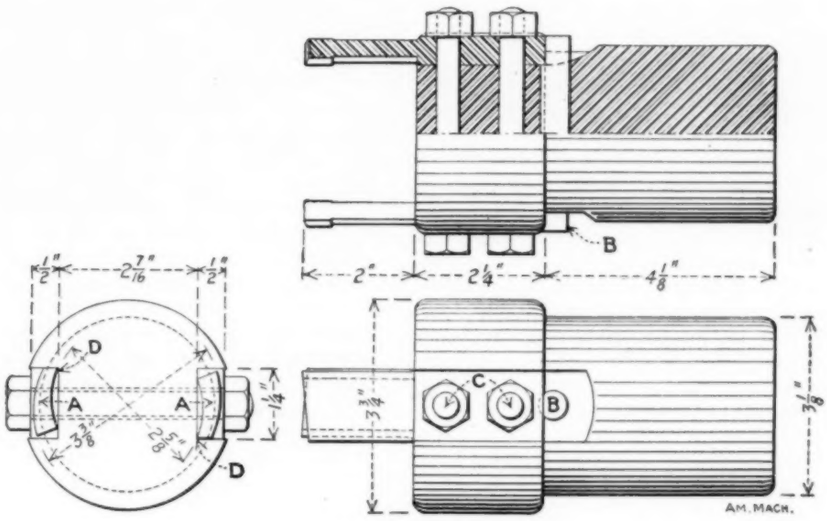
At one time I was engaged in a shop making a specialty of transmission machinery, and as there was considerable waste in the shafting department, due to ends and short pieces left after cutting the shafts to the proper lengths, it became an interesting problem to see if this material, which was generally sold for scrap, could not be turned into a marketable article. As these ends were already finished on their ends, it was suggested that by cutting them in short sections and boring them out, they would make excellent loose collars, it only remained to find a way to bore them economically.

To do this the tool that we named a coring cutter was designed, and after several modifications it made its appearance as shown in the illustration. In the construction of this tool, machinery steel was used for the body, which was turned all over, the shank being fitted to the turret lathe on which the work was to be done. Two grooves *A A* were next milled in this body, and the blades of Novo steel fitted to the grooves. The hole next to the shank was drilled and the steel pin *B* made a driving fit into it. This pin was slightly flattened at each end, as shown in illustration, to form an abutment for the blades. The blades were then clamped to the body and the two holes *C C* drilled for the through bolts. The blades were next bolted to the body and their projecting ends turned to size.

In turning the clearance in the blades, they were shimmed up along the edges *D D*, to throw the heels of the blades out enough to give the required distance. For the inside clearance the shimming was changed to the other side of the bolts. The fit of both blades and bolts was made loose enough to permit of this shimming.

The tempering and grinding of the blades completed the tool.

The cutter shown in the sketch was made for a 3 7/16-inch collar, the extra 1/16 inch being left for the reamer, which immediately followed the cutter. The faces of the collars were finished by the facing tool, and as the collar blanks were cut from the stock by sawing, the collar had to be rechucked to finish the second face. Had a cutting-off machine been available, this rechucking could have been avoided. The cutter proved a success in every respect, and stood any amount of hard service. Furthermore, we not only made a first-class collar, but showed a substantial saving over the old method of making the collars of malleable iron castings. Tools of this design have been made large enough to bore a 14-inch hole through 4 inches of forged steel, the tool in this case being fitted to the bar of a boring mill, and the work bolted to the table.



CORING CUTTER

Edgewater, N. J. ELLIS C. KENT.

Grinding Chilled Iron Rolls

In the machining of chilled iron rolls, the common method employed has been to finish them by turning. While this method has not given satisfactory results, it was never known how inaccurate these rolls were until they were finished by grinding; this operation produced rolls that were round, straight and also having a high finish.

There are many conditions governing successful roll grinding, and unless these are considered carefully the results will not be satisfactory. In grinding these rolls, some of which weigh as much as five and six tons, it is imperative that the roll be given a solid foundation. By this is meant that not only should the machine have a solid foundation, but the roll itself should be made more solid by reason of it not having any longitudinal movement. This means that the roll being ground is in fact a part of the machine. In addition to the above reasons for wheel traverse and stationary work, it would require from five to ten times the power to put a roll in motion than would be required to revolve it. Furthermore, if the roll were traversed, an unequal strain would come on the reversing mechanism, besides having varied weights upon the work-table bearings. This principle is entirely wrong, and it should be borne in mind that the heavier the work the more important it is that the wheel be traversed, and the work be kept stationary and solid.

Another important feature to be considered is the manner in which the rolls should be carried. The only correct way is to run the roll on its bearings or necks which will produce a finished roll with the face concentric with the bearings.

The matter of selecting wheels for grinding rolls, is one that demands careful study.

In the grinding of any hard material, it has been demonstrated that a soft wheel should be used. In finishing chilled rolls and especially those intended for plate rolling, an extremely high finish is necessary. Roll sizes vary as to their diameters but very often they range from 20 inches to 24 inches.

It is obvious that with a grinding wheel diameter of from 24 inches to 30 inches the grinding contact will be necessarily large; it follows that with a large contact it is more difficult to get a high finish due to the difficulty encountered in keeping the cutting points clean.

In case of a large contact existing, the wheel tends to become glazed more quickly, which makes it imperative to use a soft wheel if satisfactory results are to be obtained. An excellent wheel for this work is a 46-K Corundum.

For roughing, a work speed of from twenty to thirty feet and in finishing a speed of as high as fifty feet has given good results. For the grinding wheel traverse, a feed of one-half the width of the grinding wheel is suitable for roughing and for finishing a speed of from ¼ inch to ¾ inch per revolution of work, assuming that a wheel of from 2 inches to 3 inches in width be used. This traverse feed for finishing, which is comparatively narrow, applies to cases where an extremely high finish is required.

Waynesboro, Penn. W. G. NEVIN.

The march of mechanical progress has doomed the Asiatic caravan, which formerly transported tea across the Great Gobi Desert, of Central Asia, to Russia. This was picturesque, but as it had to cross three mountain ranges, it was extremely slow. A regular line of automobiles has cut two weeks from the time formerly required.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

A Science of Inventing

An article on page 847, entitled, "Can We have a Science of Inventing," attracted the attention of the writer in no small degree, due, perhaps to the fact that he has had some experience with inventions and is somewhat acquainted with the status of the inventor's mind. The above mentioned article did not advance any suggestions as to the scope of this proposed new science; what "axiomatic principles of mechanism" it should employ; what should constitute its subject matter.

In the absence of such I will propose that it would be necessary to arrange all inventions thus far known into subjects, classes and sub-classes in a manner similar to that in vogue at the United States Patent Office, since science is knowledge systematically classified, so that an inventor could easily find the information this new science affords for his use.

Then, since in mechanics, principles are concurrent with invention (for no principle exists but what was discovered in the creation of some invention) it follows that this new science should be a compilation of all inventions thus far known to mankind and each would be a concrete embodiment of some mechanical principle.

This reminds me of a book, entitled "Seven Hundred Mechanical Movements," which my father owned when I was a boy. I remember the first impression I received from perusing it was that the mechanisms illustrated therein comprised every movement possible in mechanics. Now if it were practical to compile a book which would contain every movement possible in mechanics, so that an inventor, in designing a new machine, would simply look over the various mechanical movements shown therein and select those adapted to his case, the rest, in many cases, would be only a job for the designer.

But the unreasonableness of the above hypothesis is too apparent to require argument. But granting it possible we would then have the subject approximating a science. With many so called inventors the process of designing is carried out in substantially this same manner, and with them, invention (?) has become a science; but when it is pursued in this manner there is no wonder the term inventor is the subject of derision. But are these men inventors? The Patent Office will not allow them that distinction, although the Patent Office, in some cases, is very liberal in granting patents for inventions.

Definition of Invention

The patent law defines invention, in numerous decisions handed down by very learned jurists, as being the product of the inventive mind, calling into action the creative powers. The courts have also held in many cases, that, where the alleged invention is possible by the exercise of such ordinary knowledge and skill as is commonly known and in every-day use by those skilled in the particular art in question, invention cannot be claimed. So if a science is to be built upon axiomatic mechanical principles it must be a science of construction. It cannot be a science of invention, since invention has to do with discovery of the unknown, and science deals with knowledge.

The act of discovery is the inventive act.

Analyzing the Inventive Process

In the article above referred to the possibility is advanced, of analyzing the thought process by which an invention is evolved. If such a thing were possible invention might be taught. In the sciences the thought process can be analyzed. With mathematics if certain hypotheses were placed before two men of equal education and ability similar conclusions may be expected. But if certain hypotheses, involving invention, are presented to two inventors of equal ability and training we can feel certain their inventions will be different.

What does this prove? That in science men can learn to reason along the same line and reach the same conclusions, because the principles of science are fixed, certain and unchangeable. But with invention men are like explorers wandering in a wilderness, an undiscovered country, without a trail. The invention they are seeking is their only guide in this wilderness of thought, and discovery, when made, is accidental. This warrants the conclusion that the inventor's thought process is not scientific, but intuitive.

Examples are numerous of trained minds, capable of the profoundest thought, being totally devoid of inventive ability. Also the examples of untrained minds accomplishing wonderful feats of invention are just as numerous.

Solving the thought process reminds me of a man I met several years ago who had the faculty of adding three columns of figures at once with less effort than the ordinary man uses in adding each column separately. I saw him perform the operation, thus satisfying myself of his wonderful ability. I was curious to learn the secret of his power and asked him to explain by what process of thought he was able to accomplish this feat. He replied very frankly that he could not explain it. He simply knew the sum as his eyes passed up or down the three columns.

Without a doubt this is an example of genius. There is, no doubt, a process of thought going on in this man's mind which cannot be explained.

So I reason, if an analysis of the inventor's thought process is to be attempted, it must be made by the inventor. If he is not able to analyze his own sensations no one else can do so; for it is impossible for one to analyze mental phenomena of which he has no means of cognizance.

The Inventive Mind

If a man's mind is adapted to invention, although he has never done any inventing, he has the possibility of invention within him; but if his mind is not so inclined he can never invent. With the former all that is required is the opportunity and the necessity, to urge him to exercise his latent powers. Then after he has brought to successful culmination his first invention he has acquired therefrom a certain experience, a fund of inventive energy which will serve to make a second invention much easier. He may go on inventing, accumulating inventive energy till it becomes comparatively an easy matter to invent. Should he then be bereft of his title, since inventing has become natural to him?

With as little reason, the circus performer who slides down the tight wire on his head with almost supernatural dexterity, deserves the hisses of the spectators, because his performance has cost him apparently so little effort.

A Possible Application

To partly satisfy the dream of the author referred to I might suggest that in many industries manufacturing such articles as machine tools, engines and like commodities, the design has become so circumscribed by set rules and principles

that science might be claimed for them. In any lines of manufacture where the design has passed out of the field of invention and become fixed by custom, such claim may be made.

But let us go back to the time when the reciprocating engine was the only type known. If inventing had then become a science, so as to eliminate the genius, we would not now have the steam turbine. Who is bold enough to assert that the telephone, when it first appeared, showed no mark of the genius; or that the incandescent electric light could have been evolved by principles known before; or that the phonograph could have been dreamed of by one hampered by rules?

Numberless inventions might be named whose genius dazzled the world when they first appeared. Now it is proposed to eliminate genius and promote invention by fixed rules. The elimination of the inventive mind will stifle progress. The dreams of one age are made the realities of the next through the inspirations of genius.

Concerning the science of medicine, chemistry, etc., referred to in the article mentioned, if we eliminate the genius from these their progress will cease. Their very existence is due to the discoveries of genius. So for the sake of humanity, for the sake of the world's progress, let us not rid ourselves of the inventor. We need him. It may not be meet though that we deify him. When he invents he is merely using the powers with which nature has endowed him. He cannot help it, he is born with that trait. He deserves no more praise than the artisan who uses all his talents to advantage.

Genius—I would broaden the meaning of the term and include all those who have knowledge or skill not acquired from others.

Cincinnati, Ohio. RIDGEWAY BARR.

Co-operation of Machine and Pattern Shops

Mr. H. P. has hit the nail on the head in his discussion of the above subject on page 940.

I would suggest that the tool-room foreman be the man in the machine shop to approve drawings before sending them to the patternmaker. The tool-room foreman is generally one of the best all-around men in the plant. He also has to make the tools for the piece and will know how they are to be finished. If some special thread is desired when he already has a tap very nearly the size wanted, he will have this changed or know the reason why.

In many shops the tool-room foreman knows nothing about the tools to be made until the castings are ready to be machined and then he is expected to furnish them in short order. Having supervision of the blueprints in advance, would enable him to know what tools were needed, and give him a chance to so plan his work that the tools would be ready at the same time as the castings.

Of course, in some of our large plants, tool designing is done in the main drafting room, or in a special department, and the tool-room foreman has little or nothing to say about the design of the tools. In this case, the head tool designer should, of course, pass on the drawings.

Milwaukee, Wis. JOHN BAILEY.

Differential Indexing on the Miller

In G. H. Longworth's article at page 823 on "Differential Indexing on the Miller," he says he has not seen any exposition of the reasoning on which this system is based presented in a manner so as to make it clear to the average miller operator, a statement with which I entirely agree. But when you find all-around machinists and others who do not understand the reasoning on which *simple* indexing is based, it is not to be wondered at if the average miller operator does not clearly comprehend the reasoning at the bottom of differential indexing.

Recently I was asked by one of our boys to explain the differential indexing principle, and after some coaxing consented, taking out my dollar "Ingersoll" and calling attention to the hands with the remark that I supposed everybody was more or less familiar with the hands of a watch or clock, so we would consider their relative movement as they rotate about the dial and then show how the principle involved in the movement of the hands of a watch or clock may be applied to differential indexing.

Now suppose we consider the hands when it is 12 o'clock. They are then together or on the same radial line one over the other. Now consider them when it is 1 o'clock. The minute hand is at 12 and hour hand is at 1 and they are 11 spaces apart counting in the direction in which they moved. It is clear then (by looking at the face of the watch) that the distance the minute hand gained on the hour hand is 11 times the distance the hour hand has moved. Now note destinctly their relative motions and positions. The minute hand moves 12 times as fast as the hour hand and the minute gains on the hour hand 11 times as fast as the hour hand moves. It should be clear then that when the minute hand has gained one whole turn on the hour hand the hour hand will have turned 1/11 of one rotation and the minute hand will have rotated 1 1/11 turns when it has overtaken the hour hand. This is the principle on which differential indexing is based. I have taken the hands of the watch for illustration because I believe this will fix it in the non-mathematical mind better than any other way.

Now consider the dividing head. The worm wheel having 40 teeth it will require 40 turns of the index crank to cause the spindle to rotate one whole turn. If, therefore, we gear the dial plate to the spindle with gears of equal numbers of teeth on each, and cause them both to turn in the same direction the dial plate will move at the same rate of speed as the spindle and as the index crank moves 40 times as fast as the spindle it will move 40 times as fast as the dial plate and the difference in the rate of speed of the index crank and the dial plate is the rate at which the index crank gains on the dial plate. These rates being in the ratio of 40 to 1 the difference in their rates of motion will, of course, be $40 - 1 = 39$ or the index crank gains on the dial plate 39 times as fast as the dial plate moves.

Suppose now we have the index crank in some particular hole in the dial plate and then turn the index crank until it comes around to the same hole in the dial plate and place it in this hole again. The index crank will have *gained* on the dial plate one whole turn and as the index crank *gains* on the dial plate 39 times as fast as the dial plate moves it should be clear that the dial plate has rotated 1/39 of a turn while the index crank has rotated 1 1/39 or 40/39 turns. This is the distance to turn the index crank to make 39 divisions, so that in, apparently, rotating the index crank one turn, we really rotate it 40/39 turns and make 39 divisions instead of 40 divisions.

Now if we place an intermediate gear in the train the dial plate will move in the opposite direction from the index crank and the rate of speed at which the index crank approaches the dial plate will be the sum of their rates or $40 + 1 = 41$; that is the rate at which the two movements of the index crank and dial plate together make one turn is 41 times as fast as the dial plate moves. Hence the dial plate moves 1/41 of a turn in this time and the index crank moves 40/41. This is the movement of the index crank required to make 41 divisions so that in apparently rotating the index crank one turn you really only rotate it 40/41 of a turn and make 41 divisions instead 40 divisions.

Now suppose we place a 40 gear on the spindle and some other gear on the dial plate, say a 60 gear. Then for every movement of the spindle the dial plate will move 40/60 of this movement and as the spindle moves 1/40 the movement of the index crank the dial plate will move 1/40 of $40/60 = 1/60$ the movement of the index crank and the index crank will move 60 times as fast as the dial plate.

The rate at which the index crank would gain on the dial plate when they turned in the same direction would be as

before, the difference in their rates, or $60 - 1 = 59$, or the index crank gains 59 times as fast as the dial plate moves so that when the index crank has gained one turn the dial plate has turned 1/59 of a turn, the index crank having turned 1 1/59 or 60/59 turns. Now suppose instead of rotating the index crank until it has gained one whole turn we stop when it has gained 40/60 of a turn. Then the distance the index crank will move to gain 40/60 of a turn will be 60/59 of $40/60 = 40/59$, which is the distance to move the index crank to make 59 divisions.

If the index crank and dial plate are made to move in opposite directions the rate at which the index crank will approach the dial plate will be the sum of their rates of motion or $60 + 1 = 61$; that is, the rate at which the two movements of index crank and dial plate together make one turn is 61 times as fast as the dial plate moves. Hence the dial plate moves 1/61 of a turn in this time and the index crank moves 60/61 of a turn, but if we cease to turn the index crank when the combined movements of crank and plate equal 40/60 of a turn the index crank will have moved 60/61 of $40/60 = 40/61$ of a turn which is the required movement of the index crank to make 61 divisions.

The stock gears usually furnished by the makers of milling machines are two gears of 24 teeth, and one each of 28, 32, 40, 48, 56, 64 and 72 teeth, except in the case of the Brown & Sharpe Manufacturing Company, who furnish in addition to these one each of 86 and 100 teeth.

It will be noticed there is no gear of 60 teeth in either list, so we could not use a 40 gear on the spindle and a 60 gear on the dial plate, but we can easily select two gears in the ratio of 40/60, which, reduced to its lowest terms, equals 2/3, and multiplying both numerator and denominator by 16 or 24 gives 32/48 or 48/72, so that 32 on the spindle and 48 on the plate, or 48 on the spindle and 72 on the plate could be used.

Now, suppose we let the sector on the dial plate remain, set as in the last example, 40/60 of the circular distance around the dial plate, but increase the ratio of the gear from 40/60 to $\frac{3 \times 40}{60} = \frac{3 \times 2}{3} = \frac{2}{1}$, that is, place a gear on the spindle of twice the number of teeth as the gear on the dial plate, and in this case we have a choice of three sets, 48 and 24, 56 and 28 or 64 and 32. In this case the dial plate will move $\frac{3 \times 40}{60}$ of the movement of the spindle, and as the movement of the spindle is 1/40 the movement of the index crank, the dial plate will move 1/40 of $\frac{3 \times 40}{60} = \frac{3}{60} = \frac{1}{20}$ of the movement of the index crank, or in other words, the index crank moves 20 times as fast as the dial plate moves. Therefore, the rate at which the crank gains on the dial plate will be the difference in their rates of motion, or $20 - 1 = 19$, or the dial plate moves 1/19 the distance the index crank gains, so that when the index crank has gained one turn, the dial plate has moved 1/19 of a turn, and the index crank has moved 1 1/19 or 20/19 turns, when they both rotate in the same direction.

When the index crank and dial plate move in opposite directions, the rate at which the index crank approaches the dial plate is, as before, the sum of their rates of motion, or $20 + 1 = 21$, or the rate the two movements of index crank and dial plate make one turn is 21 times the rate at which the dial plate moves. Hence, the dial plate moves 1/21 of a turn in this time, and the index crank moves 20/21 of a turn. If, in this case, when the index crank and dial plate turn in the same direction, we cease to move the index crank when the crank has gained 40/60 of a turn on the dial plate, the index crank will then have moved 20/19 of $40/60 = 40/57$, which is the distance to move the index crank for 57 divisions. When the index crank and dial plate rotate in opposite directions, the distance the index crank moves while the combined movements of index crank and dial plate equals 40/60 of a turn, will be 20/21 of $40/60 = 40/63$ of a turn, which is the distance to move the index crank for 63 divisions. From the foregoing it should be clear which way the dial plate should rotate with reference to the index crank, and what ratio the gears should have to make any whole number of divisions whatever.

Suppose we illustrate the method of procedure by setting up the head for 87 divisions. To do this we can select either some number less than 87 that can be directly indexed and set the index crank and sector to index this number, or we can select some number greater than 87 that can be directly indexed, and set the head to index that number, and select gears in the ratio of 40 times the difference between the number selected and 87, to the number selected. If the number selected is greater than 87, the dial should rotate in the same direction as the index crank; if less, the dial plate and index crank should turn in opposite directions. Let us select 88 to set the head to index. I have selected 88, because there are no gears of the required ratio, which will be 40 to 88. Reduced to its lowest terms $40/88 = 5/11$, and there is no gear in the set in which the number of teeth contains the factor 11. If we select 86 the gear ratio will be 40 to 86. This number could be used if you have a Brown & Sharpe machine, because there is an 86 gear in the Brown & Sharpe set, but you could not use this number on any other machine I know of. I have selected 86 to illustrate this point.

If we select 85 the ratio of gears will be $\frac{2 \times 40}{85} = \frac{16}{17}$. There is no gear containing the factor 17, so this will not do. We cannot use 89 because we need differential indexing to make 89. Suppose we try 84. Then the ratio of gears will be $\frac{3 \times 40}{84}$ because $87 - 84 = 3$ and $\frac{3 \times 40}{84}$ can be reduced to $\frac{40}{28}$ two numbers contained in the set. The 40 gear on the spindle and the 28 on the dial. The dial plate should rotate in the opposite direction from the index crank, and set the index crank and sector to index 84. Now note carefully, we can use the same setting of index crank and sector and same gears but reverse the rotation of dial plate; that is, cause the dial plate to turn in the same direction as the index crank and we will have 81 divisions instead of 87. It should not be necessary to work out here the detailed proof of this. Those for whom the subject is presented in this article should work it out for themselves, following the reasoning in the case of 59 and 61 divisions and in the case of 57 and 63 divisions.

I might add, however, that while with all four cases presented, but two gears resulting in a single train are required, there are cases when a double train or what is more generally called compound gearing is desirable. The way single trains of gears may be transposed to double has been explained in Mr. Longworth's article. It need not be repeated here.

Brooklyn, N. Y. A. P. MANN.

What is Wrong with the Pattern Shop

This question was asked by J. R. Godfrey on page 803, Vol. 34. There is nothing wrong with the pattern shop, but there may be something wrong with the blueprints, especially if the ones he turns out are like some that I have had to deal with.

The fact of his experience of having them refused by nine out of ten patternmakers to whom they were submitted, is ample proof of this, for he can take it that the intelligence of the average patternmaker has kept pace with the general advance of engineering, and is quite sufficient to enable him to read and construct patterns from any reasonable and practical drawing that may be placed before him. Either Godfrey's blueprints do not fulfil the latter conditions or the extra time that would be taken up in studying them, with the extra risk of error, would add so much to the cost of work, that they had thought it not worth taking on, the probability being that they

had other work to do from more easily read drawings.

It is quite easy to make a pattern to cost say $20 in place of $30, with the result that the casting in place of costing $40 would cost $60. In this case the pattern shop gains credit at the expense of the foundry, and the firm loses money. The drafting room stands in the same relation to the pattern shop as the latter does to the foundry, and to a more or less extent the same principle applies all round the shops. What is economy in one department may be a loss in another, therefore, if a saving is to be effected in any one shop it is up to that foreman to see that he is not simply reducing the cost of his department at the expense of another, and which in the end can be of no advantage to the firm.

W. PETERS.

Horwich, Lancashire, England.

Do Taylor's Methods Increase Production?

The article by Holden A. Evans on page 1133 is an interesting illustration of how much credit a man may gather to himself by persistent announcements that he is IT, and that no one else is in the same class. Mr. Evans begins by remarking rather plaintively that "no doubt many will consider that Mr. Taylor's principles of management were not followed." But all the same he ascribes all the credit for his success in increasing his production to that gentleman's system. Let us, therefore, glance, in review, at what he did and why he did it.

It must be assumed that Mr. Evans is in the position of having learned from Mr. Taylor certain things new to him, and of loyally bearing testimony of their efficiency. That is very splendid of Mr. Evans, but it is not exactly convincing from the point of view of showing that Mr. Taylor has some system of his very own, which is alone capable of producing such results.

In other words, has Mr. Evans not made the mistake of adopting very ordinary methods of intensifying production, and then imagining that they were peculiarly Taylorian?

The path was certainly a thorny one. It appears to have taken "two and a half years" to make "a very fair start on the road to scientific methods." No doubt, however, that unlike the hare and the tortoise, the progress was satisfactory once the long delayed start was made. Even then, however, no great likeness to the mighty complications of the Taylor system was observable. "No attempt was made to establish a scientific rate department, nor was any attempt made to give detailed instructions to the workman. The work was routed by a planning department, and each workman received written instructions of the work to be accomplished, but was not told *how* to accomplish it." Boiled down into ordinary language, what Mr. Evans did was to establish a system of written orders to the men, which orders were got out in advance of the work.

There is nothing Taylorian about this. Prearranged written orders and even elaborate routing diagrams were certainly not invented by Mr. Taylor, and have been used in advanced plants for many years. I assisted in installing such a system about 12 years ago and it was not considered a startling novelty even then.

Then we are given certain figures to prove the success of the method in reducing costs. Apart from the fact that these reduced costs do not take into account the increased cost of the organization, there is also the important objection that they were the results of introducing piece work in place of day work, in some cases at any rate. It is not easy to see whether Mr. Evans confined his piecework rates to wood calking or whether the other results were due to some system of payment also. We will assume, however, that this was not so. In that case we are asked to believe that the Taylor system reduced the time of making coaling bags *by hand* from 6½ to 2⅔ hours without extra remuneration to the worker.

These figures show us one thing with fair certainty, that is, the hopelessly antiquated and inefficient methods that must have been in vogue in that Government establishment. What Mr. Evans did, apparently, was to go through his various departments and overhaul them. He did what every intelligent manufacturer has done whenever he wished to overhaul a line of manufacture; namely, attend to the proper subdivision of labor. He found conditions that were obviously pretty bad, and reformed them, in one case by offering an increased price, though not on Mr. Taylor's system, but on the old method of piece work.

WAS THE TAYLOR SYSTEM RESPONSIBLE FOR THE RESULT?

Let us give Mr. Taylor due credit for inspiring Mr. Evans. Let us also give Mr. Evans credit for having shaken up his plant. But neither of these is in question. The real issue is whether the Taylor system is responsible for the result. If we are to take Mr. Taylor as the authority, we must decide it was not. For the particular features most insisted on by him were quite absent. In a statement which has been accepted by Mr. Taylor as an "excellent short resumé of the subject," the editor of *Industrial Engineering* has put forth the following definition of scientific management: "In every operation there are two functions, planning and performance—under the usual form of management, planning as well as performance is usually left to the workman, or to a badly overworked foreman—scientific management sharply separates the planning and the performance." So far it may be supposed that Mr. Evans' planning department fills the bill. But it does not. It was not a planning department in Mr. Taylor's sense. For the quotation goes on: "The skilled workman has but to follow the instructions in order to duplicate the work of the planning department. In its highest form scientific management provides the stimulus for the workman by giving him the rate of pay greater than the usual rate of his class when he does the work according to the time allowed, and giving him a much lower rate when he does not accomplish the task as laid down."

Thus we see that neither the element of close and detailed instructions to the man by means of "instruction cards," nor the differential rate of payment were applied by Mr. Evans. Yet these two elements are more properly regarded as being Mr. Taylor's invention than any other item in the long list of advanced methods that he has annexed to his system. In the absence of these we are rather at a loss to see what specifically Taylorian system it was that led to such good results.

No doubt, advice from Mr. Taylor would lead many of us to improve our efficiency. He is a man with a long practical experience, and Mr. Evans may be congratulated at having secured his good offices. But that is a different matter from regarding these satisfactory results as a proof that there is some specific Taylor system, which is vastly superior to all other methods of management. That is what Mr. Evans set out to prove and has signally failed to prove. He adopted some advanced methods which Mr. Taylor and many other authorities advocate, but Mr. Taylor's own pet system he did not introduce at all.

Boston, Mass. H. P. JONES.

It is unfortunate that there are flaws in everything human, for so often it is the glaring fault that attracts attention instead of the truly important and praiseworthy features. How often have we completed a machine, or a set of tools, involving novel features and accomplishing unusual results, only to have the workmanship criticized on some minor part, and no attention paid to the commendable things we had done; how often has the boss picked up, as if by fate, out of a lot of 50 or 100 pieces of work, the only piece on which we had made a slip? Just how discouraging this is, and just how it temporarily "sets a man back," we all know.

It is in just this way that Mr. Taylor's book on scientific management is unfortunate. In advancing and supporting his ideas and principles, he has made some very awkward, unwise statements, and has given examples that fail some-

how to convince one that the system as he tried it out is readily applicable to the majority of shops. Owing to these flaws or faults in the presentation of his principles, therefore, he probably has struck something of a blow to his cause, and it is my purpose to add my voice in an attempt to urge the readers of the AMERICAN MACHINIST not to lose all faith in a man's story simply because he lacked tact in telling it.

For the basic principles of Taylorism are sound; they are not new either, as he himself admits. The point he makes is, that new or old, they are the right principles and should be applied more widely than they are at present. These principles are founded on natural laws. If you will read them over, you will agree that they are good principles, and, as such, are bound to be successful. You will further agree that what Mr. Taylor proposes is a set of conditions that would benefit both employer and employee alike; and you will find reiterated a half-dozen times throughout the book the assertion that the success of the system depends altogether on the management's taking a different stand toward its workmen. Whether you realize it or not, that repeated admission from a man of the class to which Mr. Taylor belongs means the awakening among employers of a sense of responsibility that they have not felt in the past.

What the results of this awakening will be, none of us knows; we are told, and it is not hard to believe, that it means better conditions for everyone. What we do know is that opposition, either in the shape of contradiction, criticism, or ridicule, will mean delay in the realization of what is to be. Now, since we can wish for nothing better than such conditions as we are led to expect would result from a proper application of the principles of scientific management, what do you say to "pushing the good thing along?"

Let us forgive Taylor his awkwardness, and let us not take too seriously his statement that soldiering is as widespread as he would have us believe. It would be far better to work with rather than against such a movement. Then forget his mistakes, overlook his unfortunate inferences, but take home and defend at every turn the sound, humane principles of scientific management.

C. H. STILSON.

Waterbury, Conn.

The Importance of Proper Routing of Work

In the arguments pro and con on the subject of shop organization, there seems to be a failure to get back to fundamentals.

In the beginning a shop had only one man, the proprietor, who performed all functions from office boy to general manager. The question now before us began when this one man decided to enlarge his plant. He either hired a man to help him by cleaning up and laboring or else he hired another man practically his equal.

In the first case it was organization by equipment, the broom and cold chisel being assigned the helper. In the second case it was organization by product, the two men each building a machine through from start to finish. The two methods can be seen combined in varying proportions in almost any of our shops. Is either system good alone? What should determine the proportions of each? It is unnecessary to state that the arguments advanced by Messrs. Kent and Auel (pp. 1026-27, Volume 34,) are all sound. A man who runs a planer, or a foreman planer hand necessarily can concentrate his attention on the efficiency of his work better than a man who takes a piece of work from one machine to another or who attempts to direct work in a department where all different machine tools are used.

On the other hand, the shop as a whole may easily lose more than all its foremen can save by poor routing and following up of work through the shop. We are safe in saying that the determining factor in this relation is the man or men who do this routing and follow-up work, whether he be the general foreman, manager, or whatever his title. A shop so fortunate as to have a man of large caliber, with thorough knowledge of the capabilities of his men and machines, with a clear field and no favorites, and a single line of manufacture, can handle a large shop almost purely on the plan of organization by equipment. On the other hand, a small man, having a knowledge mainly of the marketing of his product, hampered by a too knowing (?) board of directors, and with a number of lines of loosely related machinery to manufacture, will be lost unless he organized according to product, or by making his shop an assembly of little shops, united only in the power plant and sales and shipping departments. Men have made great financial successes each way. Other men have failed each way.

It would appear that the first method, that of organization by equipment, would be the most profitable where possible. Its possibilities depend on the capabilities of the man who does the routing of work. Of course, it should always be understood that his routings should be a matter of record, so that his greatest work would be the routing of new jobs and the improving of the routing of old ones. This does not imply that it is safe to leave the routing of work that has been through the shop before to mere clerks without mechanical sense, nor should the routing consist in the ordering of work sent from one department to another, and leaving it to the foreman of each department to do the various jobs in the order that best suits them.

The routing must be much like the work of a train despatcher, who sees that the tracks are clear for every train and that freights are not needlessly kept on sidings. His is in all ways the most important function in the shop organized by equipment, the hardest to fill and the least developed. It is a place where real system, live, workable system is needed, for it will not do to get the shop to depending hourly on a mere human being with his varying tendencies.

When a shop has a diversified product, such that no one man can be expected to be an expert in the manufacture of the different lines, then it would, of course, be necessary to organize as many departments as might be needed in order to have an expert over each, but then it would be equally desirable to organize each department on the basis of equipment, so that the greatest economy might be had in all departments.

I feel that the point calling for the most light is the system to be used in routing, and especially in following up work through the departments.

Worcester, Mass. E. H. FISH.

Removing a Crosshead

Mr. Mitchell's article on page 217, Volume 34, does not seem to me to be good practice for removing a crosshead from a piston rod.

The cuts show what I always used for removing crossheads of engines, pumps, etc. Sometimes they stick a little, if so take a blow torch and heat the crosshead slightly to expand it.

This set of keys and drift is made of tool steel. Fig. 1 shows the keys and the drift. Fig. 2 shows a section of a crosshead and piston rod with the cross key removed, and with the wedge keys

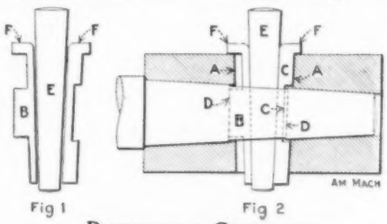


Fig 1 Fig 2

REMOVING A CROSSHEAD

and drift in position ready to drive home and disconnect.

The center on wedge key *B* bears against the end of piston rod with enough clearance, where it passes through to allow the crosshead to come off.

The top and bottom of the wedge key *C* bear against the crosshead with enough clearance where it passes through the piston rod, to allow the crosshead to come off when the drift is driven home. The shoulders *F* on the wedge keys *B* and *C* prevent them from slipping and altering their positions when driving the flat taper drift home.

Portland, Maine. J. W.

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American Machinist

OUTLINE OF TOPICS, PAGE 133

To Provide Federal Funds for Industrial Education

Senator Page, of Vermont, has introduced at the present session of Congress a Senate bill, S-3, providing for the appropriation of money from the United States treasury to establish and extend a comprehensive system of industrial, agricultural and economic schools throughout the United States. Five kinds of schools are provided for: Public schools of secondary grade, in which industrial, agricultural and economic instruction is to be given; State district agricultural schools of secondary grade; agricultural high-schools at State agricultural experiment stations established under the act of 1887; extension departments at State colleges of agriculture and mechanic arts established under the act of 1862; instruction in industrial, agricultural and economic subjects at State and Territorial normal schools.

The sums called for by the bill increase from $1,500,000 exclusive of administrative expenses for the fiscal year 1912-1913, to $12,500,000 for the fiscal year 1917-1918. The distribution of the yearly appropriations between the various kinds of schools is shown by the accompanying table.

Beginning with the fiscal year 1914 to 1915, when the intended appropriation would reach the sum of $11,900,000, nearly one-half—$5,000,000—is to be devoted exclusively to agricultural schools, and the balance to be devoted to schools giving industrial, agricultural and economic instruction.

The administration of the act is put upon the secretaries of the Interior, Agriculture and Commerce and Labor.

There is no probability that this bill will receive consideration at this extra session of Congress. Thus comment is unnecessary, other than to point out that here is a step toward obtaining Federal aid in developing a comprehensive system of industrial schools throughout this country.

The provisions of the bill are worthy of study by all who are interested in industrial and trade education, for this subject may be expected to come before us again at the next session of Congress, either in the same or some other form, and if its provisions are wise, it will merit our support.

Kind of Schools	Fiscal Years July 1 to June 30					
	1912–1913	1913–1914	1914–1915	1915–1916	1916–1917	1917–1918
Public schools of secondary grade, industrial, agricultural and economic instruction			5,000,000	5,000,000	5,000,000	5,000,000
State district agricultural schools of secondary grade			4,000,000	4,000,000	4,000,000	4,000,000
Agricultural high schools at experiment stations			1,000,000	1,000,000	1,000,000	1,000,000
Extension departments of State colleges of agriculture and mechanic arts	500,000	700,000	900,000	1,100,000	1,300,000	1,500,000
Instruction in State and Territorial normal schools in industrial, agricultural and economic subjects	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
For administration purposes	70,000	70,000	70,000	70,000	70,000	70,000
Totals	1,570,000	1,770,000	11,970,000	12,170,000	12,370,000	12,570,000

SUMS FOR AGRICULTURAL AND INDUSTRIAL EDUCATION AS SPECIFIED IN SENATOR PAGE'S BILL

Business Stability from Foreign Trade

One of the greatest stabilizing influences in a manufacturing business is a considerable, constant volume of foreign trade. It serves like a balance wheel to reduce the shocks of retrenchment and financial panic at home. When the reservoir of incoming orders is fed only from domestic streams the supply is in much more serious danger of being diminished, or checked altogether, than if some of the feeding channels rise in foreign markets. While great financial panics are usually world wide, they are not usually simultaneous in various countries. Thus the probabilities of a continual flow of orders in spite of business difficulties, if these orders come from both domestic and foreign sources, is much better than if the home market takes the entire product.

This great fact was illustrated during the panic of 1907 by the experience of an American firm manufacturing files. Some 60 per cent. of this firm's business is for export with a great deal for the far East. So when many American manufacturers were curtailing output and had almost no orders on their books, this particular firm could snap its fingers at American conditions and keep its plant busy filling the orders from abroad.

Undoubtedly one of the greatest stabilizing influences that can be brought into the machinery-building industry is export trade.

The Training of Engineers

Our English contemporaries, *The Engineer* and London *Engineering*, have given considerable space in their first issues of this month to the subject of the training of engineers. This has been occasioned by the conference of educators and engineers, held under the auspices of the Institution of Civil Engineers.

In spite of the fact that many prominent men participated in the discussion, and a large number of papers were read, *The Engineer*, commenting editorially, says:

"Disappointment, however, will be experienced in many quarters from the fact that no attempt was made to crystallize opinion and to formulate general principles for the guidance of teachers, employers and parents."

The Engineer notes that one of the prominent points brought out was the need of a combination of school training and shop experience, as is sho by this sentence: "One thing did, however, seem to stand out fairly well, and that was that the engineering employer was beginning to kick against the excess of college learning, and to demand other qualifications than the mere ability to take degrees."

All of this but shows that our English friends are earnestly considering a problem that has often been discussed with us, and with the same general trend of opinion. From a reading of the papers as abstracted and published, it seems, however, that we have gone further in combining the training of the brain and the training of the hand than has been done in English engineering schools. In fact, it seems a pity that the methods and results of such schools as the Worcester Polytechnic Institute, which for nearly 50 years has had a commercial shop in which its students are trained, and the University of Cincinnati with its admirable half-time plan, were not presented. These schools are steadily dhering to the principle of combining shop work and classroom instruction, and have produced engineers of whom they can be justly proud.

Oscar J. Beale

Oscar J. Beale, for the past 41 years associated with the Brown & Sharpe Manufacturing Company in various capacities as workman, foreman and designer, died at his home in Providence, R. I., on the evening of July 16.

Mr. Beale, early in his shop career, devoted himself to the study of gearing and gearing machines, and in mature years he became widely recognized as an authority on the subject, his book, "A Practical Treatise on Gearing," becoming a widely quoted and useful reference work.

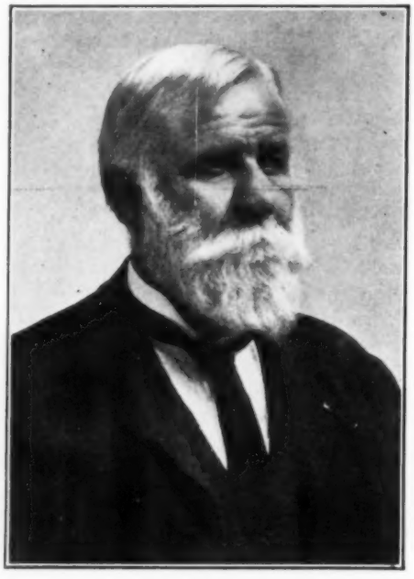
He was born in Dover, Maine, April 30, 1843, and spent his early life on a farm. In 1856 he moved with his parents to Winthrop, Me., where his first mechanical experience was gained. The following years he spent, until he came to Providence, in gathering mechanical knowledge, principally in Portland and the Portsmouth navy yard. During this time he attended Towle Academy in Winthrop, and later on took a number of lessons in drafting in order that he might become more proficient in the trade that was eventually to be his life's work.

In April, 1869, Mr. Beale came to Providence and applied for work at the Brown & Sharpe Manufacturing Company. He worked at the bench for a year and was then made assistant foreman. In September, 1872, he was made chief inspector.

A work that well illustrates his mechanical turn of mind was the invention by him shortly after he entered the employ of this company of the machine known as the odontograph, for describing the curve or outline of gear teeth. He constructed this machine in his attic at home. The company afterward bought it and it has since been presented to Columbia University.

By 1885 he became so well recognized in the Brown & Sharpe plant that he was placed in a position where he could exercise his inventive ability, and it fell to him to carry on to completion several lines of work that Joseph R. Brown had begun, with whom he had been in close association and sympathy.

Probably Mr. Beale's best work has been in the producing of accurate standards of measurements, in the designing



OSCAR J. BEALE

of measuring machines, and in the perfecting of machinery for making accurate graduations. For his measuring machines he received a diploma of honorable mention at the Columbian Exposition in 1893. Later the Louisiana Purchase Exposition awarded him a silver medal for his work in connection with his company's exhibit.

A piece of work with which his name was often linked was the production of a standard yard, which included the development of special tools and a comparator, with which he spent over a year's time. When completed the work was compared with the standard yard at Washington and was found to be accurate within 0.00002 inch.

Among Mr. Beale's inventions are found an automatic bevel-gear generating machine of distinct originality and many improvements of a varied sort, which have materially benefited modern manufacturers. Many patents were taken out by him, and all of his efforts have been notably contributory to the success of the company for which he worked.

His mechanical conception and analyzing powers were developed to an unusually fine degree, coupled with which were the patience and persistency of the true mechanic. In his long mechanical life work he was materially assisted by a remarkably retentive memory.

Mr. Beale wrote extensively for the technical press, and his articles always possessed an authority which commanded attention, and through which he became well known to the mechanical world at large.

OBITUARY

James C. Brooks, president of the Southwark Foundry and Machine Company, Philadelphia, Penn., died in that city on July 19. Mr. Brooks was 77 years old.

PERSONALS

H. H. Bailey, formerly an instructor in mechanical engineering at the Ohio State University, has joined the drafting department of the Packard Motor Car Company, Detroit, Mich.

Frank J. Lapointe who has been superintendent and shop manager of the Lapointe Machine Tool Company, is now acting in a similar capacity with the J. N. Lapointe Company, Marlboro, Mass.

Joseph Borovitz, until recently factory manager and chief engineer of the plant of Adams Brothers Company, Findlay, Ohio., has accepted a similar position with the F. A. L. Motor Company, Chicago, Ill.

W. A. Sterns, until recently mechanical engineer with the Louisville & Nashville Railroad Company, has resigned to become assistant to the chief mechanical engineer of the American Steel Foundries at St. Louis, Mo.

J. N. Lapointe, until recently president and manager of the Lapointe Machine Tool Company, Hudson, Mass., has severed that connection and is now president and manager of the newly organized J. N. Lapointe Company, Marlboro, Mass.

Tracy Lyon, until recently assistant to the first vice-president of the Westinghouse Electric and Manufacturing Company, has resigned in order to become director of production, in general charge of manufacturing, engineering and purchasing, of the General Motors Company, Detroit, Mich.

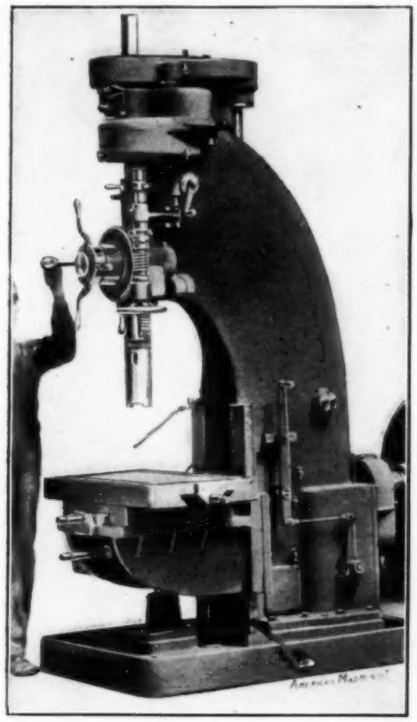
Lucian Haas for the past few years chief tool designer of the E. R. Thomas Motor Car Company, Buffalo, N. Y., and a regular contributor to our columns, has resigned in order to accept a similar position with the U. S. Motor Company, and will be located for the present at their Alden Sampson plant in Detroit.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

High Duty Driller

The accompanying halftone shows a 36-inch high-duty driller manufactured by the Foote-Burt Company, Cleveland, Ohio, and exhibited at the recent Master Mechanics' and Master Car Builders' conventions at Atlantic City, and on which record drilling tests were conducted, using high-speed drills made by the Cleveland Twist Drill Company, some of



HIGH-DUTY DRILLER

the results of which were given in our report of the convention, published on page 1189, Volume 34, in addition to which a record of 57½ inches per minute in cast iron with a 1¼-inch flat twist drill at a peripheral speed of 188 feet was made.

The machine shown is one of a line of seven sizes, developed by this company, and has a capacity for high-speed drills up to 3½ inches in solid steel.

The main driving shafts at base and top of machine are equipped with Hyatt roller bearings, and all other bearings are bronze bushed. All feed changes are accomplished through a quick change-gear device operated by levers located at the front of the machine within easy reach of the operator. Spur gears are used throughout, one pair of miter gears at the driving end and one worm and worm gear for the feed.

The spindle is of forged high-carbon steel, fitted with ball-bearing thrust. Nine changes of geared feed are provided, any one of which is instantly available without stopping the machine. Power feed is provided with adjustable automatic stop and hand stop. The table is of the bracket-knee type, having a large square lock-bearing surface on the upright, to which it is gibbed, and further supported and elevated by a square-thread telescopic jack screw.

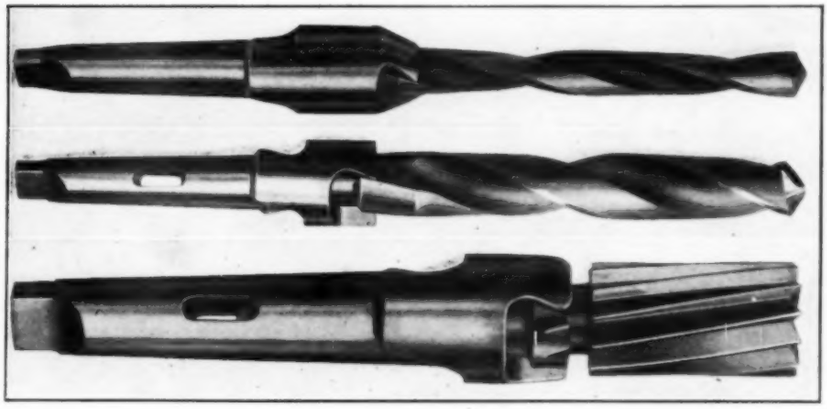
The regular drive consists of a four-step cone pulley, and the motor drive, with which the machine illustrated is equipped, consists of a 20-horsepower four-to-one variable speed, 300 to 1200 revolutions per minute, motor, geared direct with a two to one reduction. Back gears give a further reduction of four to one, obtaining spindle speeds of from 37½ to 600 revolutions per minute. An extra attachment is a compound table, consisting of an entirely new knee. It has a longitudinal adjustment of 14 inches and cross adjustment of 8 inches, the top platen of which has a working surface of 16½x30 inches.

Corona Driving Sockets

The accompanying halftones show a new style of drill, reamer and milling-tool socket, designed to drive all standard twist drills or drills made up of the different forms of twisted shapes. The upper view shows the involute style for driving drills made up from twisted form of steel, the center view the more usual form for holding standard twist drills, while the lower view shows the style for holding end mills and reamers.

In using the type of socket shown with the standard twist drill the flute of drill is carried through to the root of shank, but not below the diameter of shank: At this point when used with drills made up from twisted shapes, the shank is turned up without any change in original shape and the socket engages and drives from the flute. Milling tools and reamers are made with taper shank, with an engagement to conform with the projecting drive, or engagement on socket. It is also designed to equip drillers millers, etc., with the same engagement upon the spindle.

With this style of socket there is no possibility for broken tangs, worn sockets on account of the drill turning there-



DRIVING SOCKETS FOR DRILLS, REAMERS AND END MILLS

in and tool breakage is avoided by the positive and direct drive. It is applicable to the standard tool equipment. A wide range of work can be accommodated by the nesting of sockets.

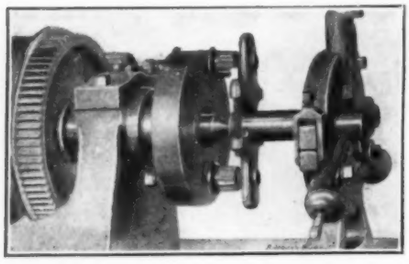
Drills with broken tangs can be machined to fit this socket by cutting the flute through to the root of the shank.

This style of socket is known as the "Corona" and is a recent product of the Corona Manufacturing and Supply Company, 311 Atlantic avenue, Boston, Mass.

Holdback and Faceplate Dog

The device shown in the halftone herewith is designed to be used instead of belt lacing, or hook bolt, in order to hold work up to the head center, with the other end running in the steady rest.

It consists of an adjustable dog or driver, and two bolts passing through the faceplate, on which bolts are spiral springs as shown back of the faceplate. One setting of the bolts is sufficient. The springs permit the necessary flexibility while the work is held securely while the bolts can be adjusted so as to draw equally on both ends of the dog, thus causing the work to run true in the steady rest.



HOLDBACK AND FACEPLATE DOG

Two sizes are made, to accommodate work from ¼ inch to 2 inches and 1 inch to 3½ inches respectively, by the M. B. Hill Manufacturing Company, Worcester, Mass.

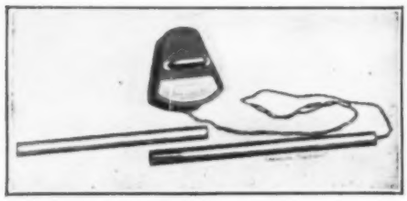
Radiation Pyrometer

The instrument shown herewith has recently been developed by the Thwing Instrument Company, Philadelphia, Penn.

The principle employed is the measurement of the total energy of radiation by means of the current generated in a sensitive thermocouple by the radiations concentrated upon it, a principle already employed by Féry in his pyrometric telescope.

In this pyrometer use is made of a conical mirror for concentrating the radiations for the purpose of avoiding loss of time required for focusing and eliminating error due to inaccurate focusing.

The galvanometer used does not require leveling and is at the same time sufficiently sensitive to respond to the small current generated in the thermocouple by a difference of temperature never exceeding 100 degrees Centigrade. A pivoted coil is used in the construction which makes unnecessary leveling. The design of galvanometer used employs very light magnets and the complete instrument weighs but four pounds.



PORTABLE RADIATION PYROMETERS

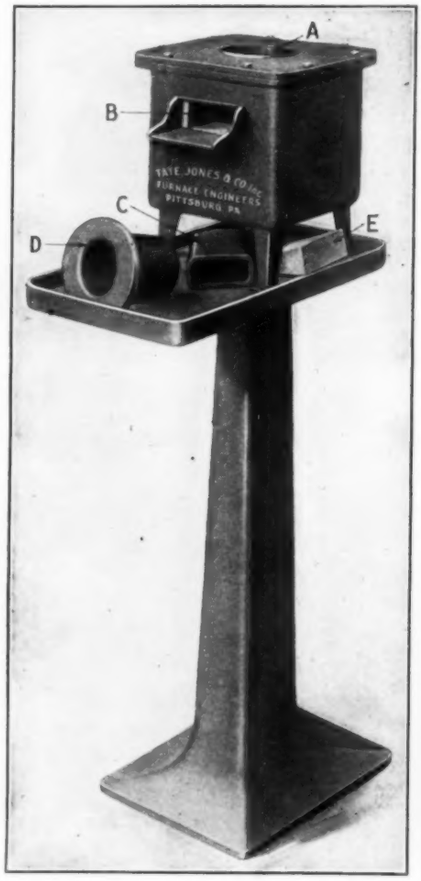
The pyrometer responds instantly to temperature changes, attaining a state of equilibrium in five seconds after pointing at the hot surface and returning as quickly to null reading when the radiations are cut off. The possible range of temperature is unlimited in either direction.

This instrument is especially well adapted to the measurement of temperatures in open-hearth furnaces and it is, of course, desirable to supplement such measurements with determinations of the temperature of the molten metal at various stages.

Combination Toolroom Furnace

The accompanying halftone shows a hardening furnace adapted for general toolroom work.

The heating chamber is 6 inches square and 6 inches high, and is direct-fired by a gas flame. For delicate work the muffle *C* is inserted into the mouth *D*. For lead hardening and tempering, or for case-hardening small work, the pot *D* is readily available.



COMBINATION TOOLROOM FURNACE

The furnace is of simple construction and a handy size and is a recent product of Tate, Jones & Co., Pittsburg, Penn.

Flexible Coupling

In Fig. 1 is shown a flexible coupling as it appears connecting two shafts set at an angle to each other, and it is adapted to connect shafts out of line in varying degrees. It is devoid of projecting parts on the outside.

The main internal construction is shown in Fig. 2. Bolts or screws are entirely absent in the construction. The coupling can be readily dismounted without disturbing the bearings and alinement of either shaft, which is accomplished by pressing a spring plunger which releases the housing. Oiling is accomplished by pressing the same plunger that retains the housing and placing oil or suitable grease into the opening thus formed. A large cavity is formed around the body and underneath the housing, from which the lubricant is automatically fed through suitable grooves to the working parts by centrifugal force. This cavity is sealed at the opening where the oil or grease is applied by the spring plunger. A dust cap spun out of sheet steel over a former of the same spherical radius as that of the ends of the housing is secured to the outer ends of the hubs, or sleeves, bearing against the housing and held there by a slight spring pressure. This dust cap prevents any foreign substance from entering the working parts of the coupling and tends to retain the oil or grease that is placed inside.

FIG. 1. FLEXIBLE COUPLING

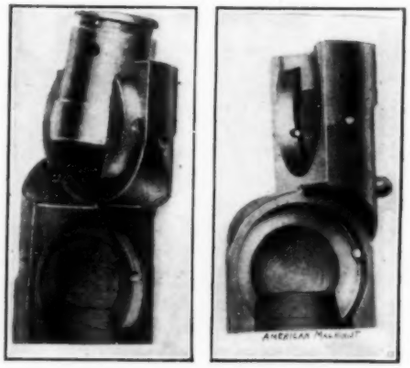


FIG. 2. INTERNAL CONSTRUCTION

The couplings are furnished in sizes covering the range of shafts from ⅝ to 1⅝ inches in diameter, in both single and

double types. They are a recent product of the Victor Appliance Company, Watervliet, N. Y.

Machinists' Jack Screw

This jack screw is made with a telescoping base, giving a wide range of adjustment. All parts are of steel, machine-turned, and case-hardened.

MACHINISTS' JACK SCREW

The tilting cap has a milled V-slot adapting it for use under round work, and with the top removed the base is suitable for use as blocking, giving a range of from 1 5/16 inches low to 2½ inches high.

It is made by W. A. Peck, New Haven, Conn.

Bolt Threaders

The accompanying halftones show two new types of threading machines, recently brought out by the Landis Machine Company, Waynesboro, Penn.

Fig. 1 shows a ½-inch double-head bolt cutter, in which are used steel guides instead of cast-iron guides, as has been the common practice. The steel guides are accurate to size and have a tendency to maintain perfect alinement. When necessary they can readily be replaced. There is no tendency for cuttings to collect on the guides and cause wear. The machine is built with a wide body, with large space for chips, and the oil tank in the base is separated from the chip room by a fine screen. The oil pump is on the rear of the machine and is of the rotary type. The machine is built for high-speed work and is furnished almost exclusively with high-speed steel dies.

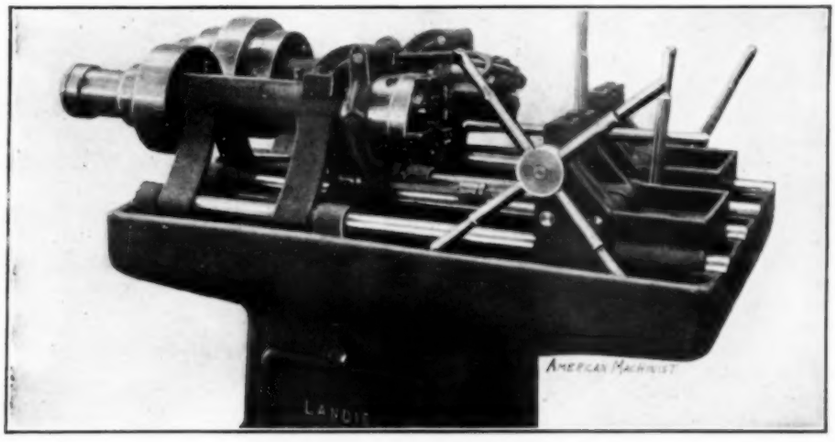


FIG. 1. BOLT THREADER WITH STEEL GUIDES

Fig. 2 shows a 1-inch double-head bolt threader with constant-speed motor, silent chain drive, with a mechanical speed-change device in the gear box, as shown. This gives a speed range of 3¼ to 1. Speed changes can be made while the machine is in operation. The carriages on this machine have adjustment up and down sidewise for centering to the die, and are furnished with either rack and pinion or with lever.

This company is also building a 1½-inch motor-driven double-head staybolt cutter with variable-speed motor, having a speed variation of 4 to 1, so that a very wide range of speeds can be had for taking in any work between minimum and maximum, as well as making it possible to take advantage of using either carbon or high-speed steel dies, as the case may require. This machine is also furnished with lead-screw attachments for one or both heads, as may be desired, and will be arranged to cut any pitch and any diameter within the range of the machine by changing gearing, no extra lead screw being required.

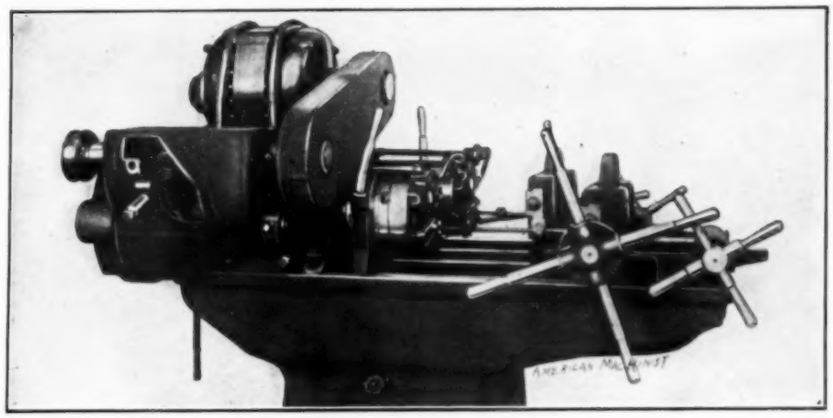
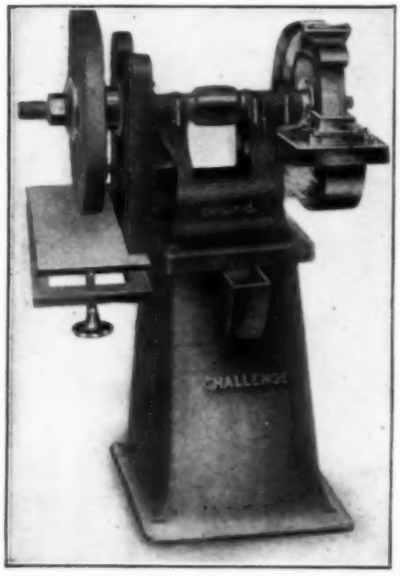


FIG. 2. MOTOR-DRIVEN DOUBLE-HEAD BOLT THREADER

Combination Grinder

The grinder shown herewith is a combination machine, the halftone showing it set up for regular and surface grinding. The surface-grinding attachment can be arranged so that the wheel will grind from above or below the work. This is accomplished by inverting the attachment, which is L shaped, its vertical member being open to straddle the bearings, and slotted, thus permitting vertical adjustment. Inasmuch as such adjustment is more or less approximate a plate is hinged to it and provided with an elevating screw so that fine adjustment can be obtained.

On the opposite side is the regular grinding arrangement with provision made for supply of water for tool grinding. It consists of a reservoir bolted to the head, a hood covering the upper portion of the wheel, and a curved piece which, on being depressed, displaces the water. This



COMBINATION GRINDER

raises the water to the wheel and it is thus carried over to the tool, the amount of water being regulated by the position of the curved piece as shown on the top of the hood. The hood can be readily removed and wheels of different sizes and character mounted for various purposes.

The bearings are of the ring-oiling type and a cam set collar is provided for taking up the end play.

The machine is made in four sizes, ranging from 12 to 18 inches diameter of wheels, by the Challenge Machine Company, Philadelphia, Penn.

Split Pulley and Positive Clutch

The type of pulley shown in Fig. 1 is of a new design and of a combination construction, consisting of a split built-up wood rim of segments of kiln-dried maple, rendered moisture and temperature proof; arms of annealed, cold-drawn steel tubing, pressed into a ribbed shape calculated to give lightness with strength; and a split malleable-iron compression hub, into which are inserted interchangeable cast-iron bushings.

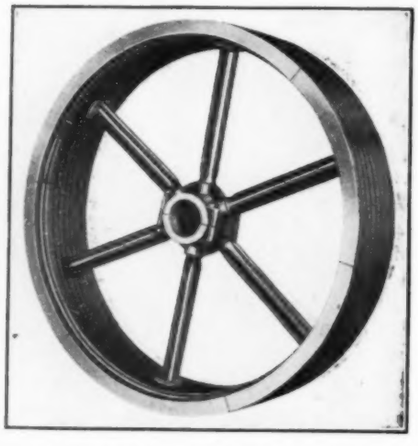


FIG. 1. POSITIVE SPLIT PULLEY

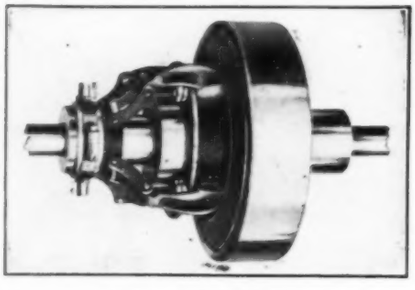


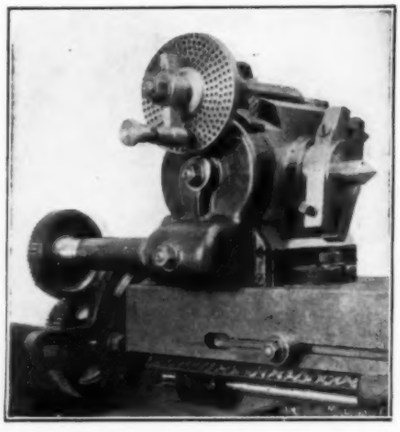
FIG. 2. POSITIVE CLUTCH

In Fig. 2 is shown a positive clutch, the design of which utilizes both the friction and jaw principles. The clutch may be applied to coupling shafts of any speed against full load. First, the frictions are thrown in, and when the driven shaft attains the speed of the driver, the jaws engage and transmit the power, the frictions then reversing.

Both of the developments shown are recent products of the Positive Clutch and Pulley Works, 30 Lansing street, Buffalo, N. Y.

Large Index Wheel for Miller

Many millers are equipped with comparatively small index wheels, the diameter of which is limited by the construction of the dividing head. Of course, with a small index wheel, it is difficult to index accurately, especially in milling pieces of work of large diameter.



LARGE INDEX WHEEL FOR MILLERS

To overcome this difficulty, Gildemeister & Co., Bielefeld, Germany, have equipped their millers with an index head, shown in the accompanying illustration, which has a very large two-part index wheel well adapted for accurate indexing.

Motor Driven Grinders

The Garvin Machine Company, New York City, have equipped two of their standard grinders with motor drive. Their regular No. 3 universal cutter and surface grinder, for grinding all forms of milling cutters ranging in size from 14 inches diameter, 6 inches face, down to the smallest, and capable of surface grinding surfaces 6 inches wide by 9½ inches long, has been equipped with a constant-speed motor, ⅙ horsepower, 1800 revolutions per minute.

Another machine similarly equipped with a constant speed ½ horsepower 1650 revolutions per minute motor, is their regular surface grinder, accommodating surfaces 7 inches wide by 9½ inches long, and of a thickness of from ⅛ inch to 6 inches.

Testing Apparatus for Gear Wheels

The accompanying Figs. 1 and 2 show an apparatus for testing gears before they are put into operation.

In testing spur gears, they are placed on blocks resting on a bed as shown, and brought into mesh by means of a screw that controls one of these blocks; the other block is stationary. The distance at which the gears run noiselessly is determined, and read from scale seen on the side of the bed.

In testing bevel gears, a block holding the pinion is slid back or forth in the column seen on the left of the machine, Fig. 2.

The distances determined by this machine are very useful in pairing off the gears so as to make the distances for quiet running coincide with the center distances of the machine.

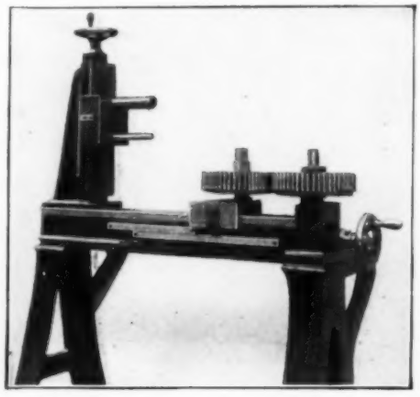


FIG. 1. TESTING SPUR GEARS

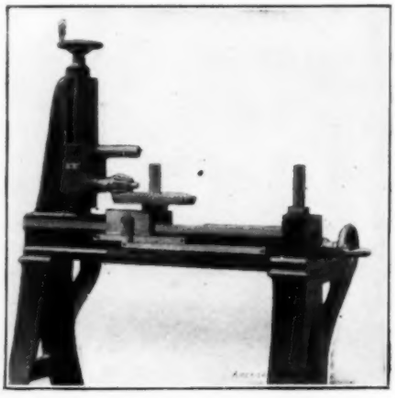
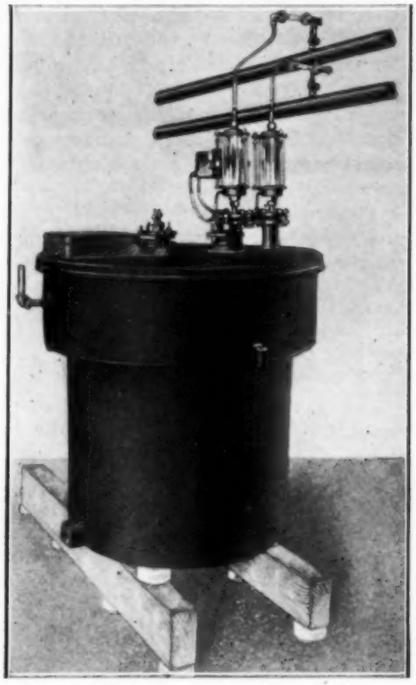


FIG. 2. TESTING BEVEL GEARS

Generator for Oxygen and Hydrogen by Electrolytic Process

The accompanying halftone shows a generator developed in this country by the International Oxygen Company, New York City, for generating oxygen and hydrogen on the electrolytic principle.

The construction of the generator is simple, the iron tank serving as the negative pole. From the cover of this tank are suspended an hydraulic joint and a perforated tank which serves as the positive pole. By means of an asbestos sack suspended from the hydraulic joint, two separate compartments are formed. Through an opening in the cover a solution of water with alkali is poured into the hydraulic joint and distributed in the two compartments. When current is sent in the generator oxygen immediately forms on the walls of the inner tank, and hydrogen on the walls of the outer. The two gases are thus produced in separate compartments and are therefore of a pure nature. As a further check against any possible mixing of the gases the asbestos sack, when impregnated with an alkali solution, forms an effective wall between the two gases.



GENERATOR FOR PRODUCING OXYGEN AND HYDROGEN BY THE ELECTROLYTIC PROCESS

A special feature of this generator is that the hydraulic joint automatically adjusts the inner working of the generator. The oxygen and hydrogen do not pass directly from their respective compartments to the takeoff pipes, but first bubble through the water placed in the lanterns affixed to the cover of the generator. By means of these, one can see at a glance how the generator is working.

The illustration herewith shows one of the units which can be arranged singly or in multiple to meet varying conditions.

In addition to manufacturing generators the International Oxygen Company will also produce oxygen and hydrogen in cylinders.

Hydro Pneumatic Driller

The illustrations show a new machine, designed by Messrs. Bocorcelski and Lassiter, and being marketed by the Walter H. Foster Company, of New York. The head shown in Fig. 2 is used on a radial arm, although it is evident that the same type of drilling mechanism can be used in any form of machine desired.

The drilling spindle is driven by the motor *A* through a set of gears, which gives two speeds of the spindle for each motor speed, the direction of rotation being controlled by a drum type of controller, and when used for facing or tapping, the feed may be operated by a handwheel in either direction.

The feed is controlled by a four-way valve *F*, which controls the passage of the air and determines whether it shall be on top of the piston, forcing the piston down into the work, or forcing the oil back into the cylinder under the piston or returning the spindle to its original position. Air at 80 pounds pressure comes on top of the piston and forces the oil underneath it through a graduated passage through valve *E*, the opening of this passage depending on the speed with which the oil can pass and controlling the rate of spindle feed. This, it will be seen, makes the feed in a measure dependent on the resistance to the drill, and if the cutting resistance becomes greater than the total air pressure, the spindle can only revolve but not advance into the work. Eighty pounds of air pressure is used, and this is the common practice in shops using compressed air.

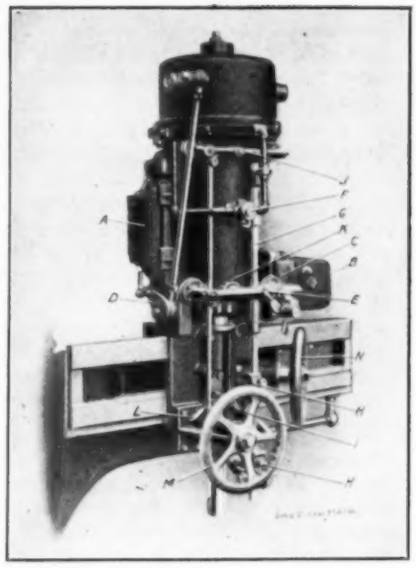


FIG. 2. DETAILS OF HEAD

The various lettered parts are: *A*, the motor; *B*, controller having the resistance *C* attached to it. Lever *D* operates high- and low-speed gears through a clutch. Feed-operating valve *E* has a flat seat graduated to permit the passage of

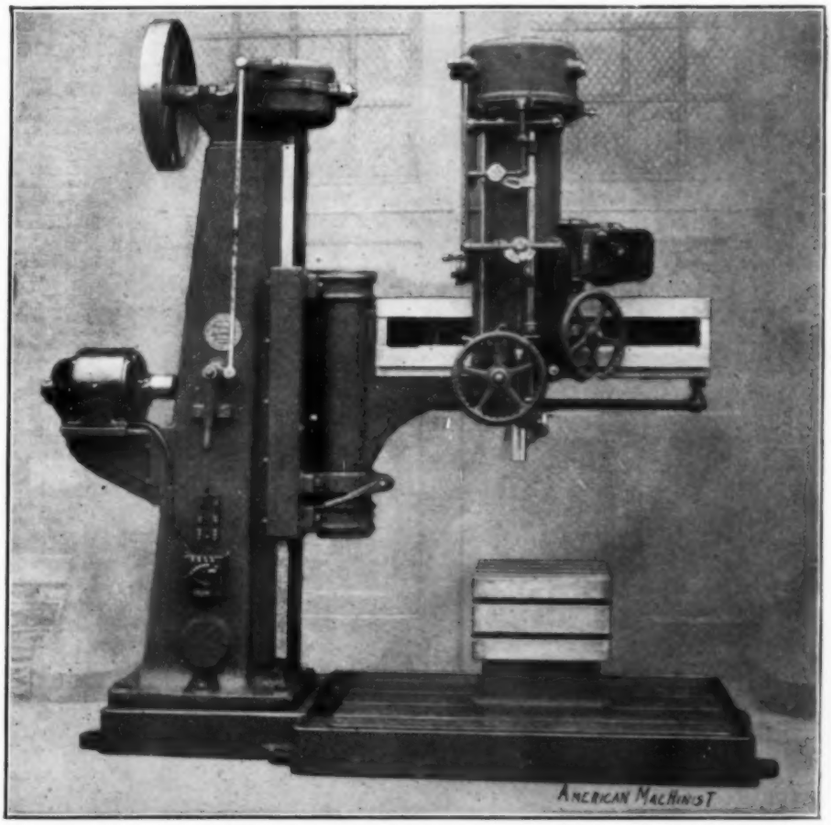


FIG. 1. HYDRO-PNEUMATIC DRILLER

oil from the cylinder to the surrounding chamber. Four-way valve *F* controls passage of air, while the air valve is operated by vertical shaft *G*, which carries adjustable trip dogs *H H*. These can be swung out of the way when the spindle is operated by hand and will not interfere with the tappet *I*, which slides with the spindle. By-pass valves *J* and *K* are operated by lever *L* to the connecting rods and allow the air and oil to pass freely in either direction while operated by hand. Handwheel *M* has pinion engaging with rack for hand operation of spindle, while handwheel *N* has spiral gear engaging rack for adjustment of head on the arm.

In this construction the piston, with its air pressure on top and the oil beneath, together with the connections and controlling valves, takes the place of the usual gearing used to secure changes of feed. The opening for the passage of oil can be directly controlled, by a valve *E*. There is no tendency for the drill point to draw in, when breaking through the holes. It is claimed that this absence of gearing greatly reduces the amount of power required both for feeding and for driving the drill. A 3-horsepower motor is used on the 2 9/16 inch spindle, and a 5-horsepower motor on the 3¼-inch spindle, the spindle in each case having a vertical travel of 15 inches.

At the present time radial drillers having 4- and 6-foot arms, weighing 7000 and 12,000 pounds, are listed.

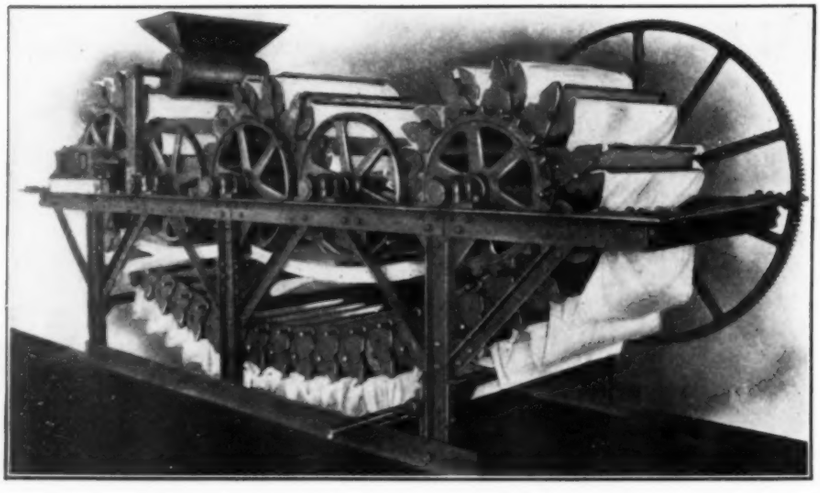
A New Continuous Filtering Press

J. J. Berrigan, 136 North Center street, Orange, N. J., recently developed a filtering press which is interesting on account of the mechanical principles involved. This machine was designed to remove the liquid from mash and anything of a similar nature and differs from most other continuous filters in that a majority of them are designed on roller principles.

The machine shown herewith has 54 buckets or "links" in the chain which travels under two pulleys and over the others, but the machine may be made any suitable size, length or number of buckets.

The principle of the machine will be grasped at once, as the buckets open when going over the pulleys and close when going under, the amount of pressure on whatever is between the pan and rocker of the bucket depending on the weight of the chain used with all the buckets full the chain underneath is almost straight and an interesting point is that a stick or stone may be placed in one of the buckets and the chain will automatically adjust itself without damage. Cloth or screen of any mesh may be used in the buckets to filter through.

In the machine shown the material is fed from the hopper on the left and the chain travels toward the right, emptying the buckets into whatever is placed under the end of the machine to receive the material, the liquid running off through the two troughs shown under the second and fourth pulleys. The machine runs slowly and being largely back geared uses surprisingly little power, even when full.



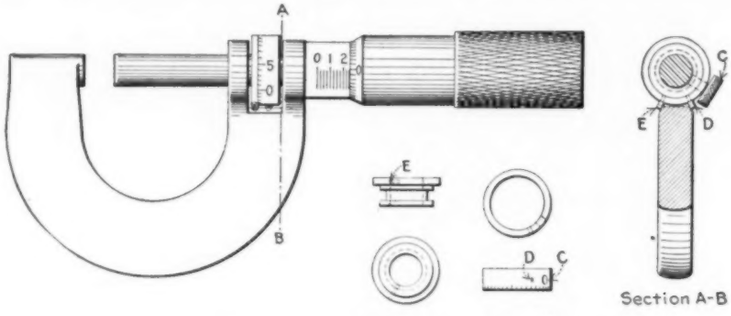
A Continuous Filtering Press

Improved Adjustable Micrometer Lock Nut

By Robert R. Cornell

The accompanying figure shows an original idea for a micrometer lock-nut. It consists of an inner body or bushing, fitting freely on the measuring bar, and has a fillister-head screw *E* as shown in the section, on the face of its outer diameter. This bushing has a segment milled out of its smaller diameter, as shown in the detail. This allows a graduated outer bushing having a screw *D* like *E*, to revolve around it 300 degrees or more and capable of being locked securely by a thumb-screw in any position within its range of movement.

The object of this device is to furnish the workman a means of setting the micrometer to suit drawing limits up to 0.020 inch. For example, suppose that a number of parts were to be measured as they come from the machine or inspector, and the specifications called for all the pieces to measure not more than 0.002 inch above or below a given size, or a variation of 0.004 inch between maximum and minimum.



Improved Micrometer Adjustable Locking Nut

To adjust the lock-nut in this case, set the micrometer to the maximum size, and turn the graduated outer ring around the inner bushing until the fourth graduation is opposite the zero line on the flange. By tightening the thumbscrew *C*, the bushings cannot turn upon each other or the shaft, and the thimble of the micrometer can turn only as far as the heads of the screws *D* and *E* will allow, as they act as stops upon the beveled side of the frame, as shown in the section.

After the micrometer has been adjusted to the limits and the nut locked to the shaft, the micrometer is ready to measure all pieces within the limits, as a slight turn to the right or to the left of the thimble allows every piece of proper size to pass between the measuring faces.

I believe that every machinist has felt the need of an improvement of this kind on micrometers and I think that some maker who could bring out a tool similar to the one in the sketch, would find it would meet with a demand sufficiently large to pay.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Narragansett Machine Company, Pawtucket, R. I., is building an addition to its factory.

The Atlas Tack Company, New Bedford, Mass., has awarded contract for erecting a new factory.

Morgan & Zusman have started a new manufacturing jewelry shop at 213 Blackstone street, Providence, R. I.

Edwards & Edwards contemplate building a factory at Waterbury, Conn., for manufacturing scythe snaths.

A commercial garage will be erected in Adams, Mass., at the junction of Maple and Depot streets, by Henry Ruel.

The blacksmith shop and sawmill of C. W. Smith & Sons, South Waterboro, Me., was destroyed by fire. Loss, $25,000.

Permit has been granted to S. N. King to erect a machine shop on Hanover street, Springfield, Mass., at a cost of $2000.

The Archer Company, New Haven, Conn., has been incorporated with $50,000 capital to manufacture tools, by Frank R. Graves, S. B. Pettengill, etc.

The Davis Motor Car Company, 26 Custom House street, Providence, R. I., has been incorporated with $400,000 capital. A. L. Turgeon, president.

The Bicknell-Thomas Company, Greenfield, Mass., has organized with $15,000 capital to manufacture specialties in small machinery. F. O. Wells, president; W. C. D. Thomas, treasurer.

The Carr Fastener Company, Boston, Mass., manufacturing metallic fasteners, will move its plant to South Framingham, Mass., where it has purchased a tract of land and will erect a new factory.

The Dunham-Peck Company, Gloversville, N. Y., manufacturer of machinery, contemplates moving its plant to Pittsfield, Mass., where a site has been selected. It will increase its capacity.

The R. H. Long Machinery Company, Hartford, Conn., has been incorporated to manufacture machinery, etc. Capital, $400,000. Incorporators, Louis Horowitz, Joseph Horowitz, E. J. Cummings.

Worcester Polytechnic Institute, Worcester, Mass., will erect a new building for a hydraulic-testing laboratory. It will be equipped with hydraulic-testing machinery and also for testing all kinds of gear and belt drives.

MIDDLE STATES

O. E. Dishaw's machine shop at Canton, N. Y., was burned.

Louis Schwartz, of Detroit, Mich., is erecting a garage on Canton street.

J. C. Ritter, of Detroit, Mich., is having a garage built on Field street.

The Rockford (Ill.) Tool Company will erect an addition to its plant.

The Rummel Machine Company, Cleveland, O., will erect a machine shop.

The Nute Foundry Company, Cuyahoga Falls, O., will build an addition.

Goethe Link will build a garage at 2850 Tabott avenue, Indianapolis, Ind.

The Pratt Chuck Company, Frankfort, N. Y., will erect new factory building.

Charles D. Harris will build a garage at 2427 Central avenue, Indianapolis, Ind.

The Hocking Valley Railway will erect a 10-stall roundhouse at Walbridge, Ohio.

The Big Four will shortly send out a machinery list for its Indianapolis shops.

The Diebold Safe and Lock Company, Canton, Ohio, is in the market for machinery.

Warren Eelct, 1661 East Eighty-first street, Cleveland, O., will build a garage.

Harry Gill, Jr., will build a garage at 2109 North Thirty-Third street, Philadelphia, Penn.

The plant of the Hamilton Foundry and Machine Company was damaged by a recent fire.

A garage is to be built on Chester Pike, Glenolden, Philadelphia, Penn., for John D. Avil.

The Metzger Motor Car Company is erecting a large addition to its factory at Detroit, Mich.

J. E. Fenis, 10,924 Magnolia drive, Cleveland, O., has taken out a permit for a garage.

The Cleveland Railway will expend approximately $2,500,000 for betterments and extensions.

The King Motor Car Company, of Detroit, Mich., is planning extensive additions to its plant.

The Bay View Foundry Company, Sandusky, O., has doubled its capital and will improve plant.

The American Safety Lamp and Mine Supply Company, Scranton, Penn., will erect an addition to plant.

The Cincinnati Car Company, Cincinnati, Ohio, has issued specifications for additional mechanical equipment.

The Root & Vandervoort Engineering Company, East Moline, Ill., is erecting a $25,000 addition to its foundry.

The Globe Machine and Stamping Company, Cleveland, O., is building two new additions to its plant.

The Seitz Auto Transmission Company has completed its plant at Wyandotte, Mich., and will need equipment.

C. W. Young & Co. have let contract for a garage to be erected at 1239 West Forty-First street, Philadelphia, Penn.

The Cadillac Motor Car Company is erecting a large addition to its Trombly street machine shop at Detroit, Mich.

The Anderson Electric Car and Carriage Works, of Detroit, Mich., is to erect an addition to its present factory.

The Minneapolis, St. Paul & Sault Ste. Marie Railroad will rebuild roundhouse recently burned at Waukesha, Wis.

The Foster Motor Sales Company will erect a garage, machine shop and salesroom on Woodward avenue, Detroit, Mich.

The Aluminum Foundry Company, Sebring, O., has been incorporated to manufacture aluminum castings by F. Bauch, etc.

The Simplex Automobile Company, of New York, is preparing list of tools required for new plant in New Brunswick, N. J.

A permit has been issued for a garage to be built at 5869 Overbrook avenue, Philadelphia, Penn., for Mrs. Arthur Patterson.

The Burke Electric Company, Erie, Penn., has commenced the erection of another addition in order to increase output of motors.

F. Addison, of Detroit, Mich., is erecting a two-story garage and machine shop for the care and repair of automobiles on Michigan street.

W. F. Collins, 2091 East Nineteenth street, Cleveland, O., will erect a new shop for the manufacture of dies, tools, machinery, metal stampings.

The Parsch Auto Livery Company, Cleveland, O., has been incorporated to operate a garage, by J. A. Burke and Charles A. Aaron, etc.

Structural work has been commenced on new plant of the Union Steel Casting Company in the Lawrenceville district, Pittsburg, Penn.

The Lees-Bradner Company, Cleveland, O., manufacturing gear cutters, has awarded contract for erection of new plant at 6210 Carnegie avenue.

The Lanston Monotype Company has had plans prepared for a six-story factory at Twenty-Fourth and Locust streets, Philadelphia, to cost $250,000.

The Economy Stove Company, Cleveland, O., manufacturing gas stoves of all kinds, has incorporated, and will make large additions to present plant.

The Superior Bed Spring Company, of Detroit, Mich., has been incorporated by W. J. Klein, Charles Holland, etc. Will begin operations shortly.

The Newark Automobile Company, Essex building, Newark, N. J., is arranging to purchase equipment for plant for the manufacture of automobile trucks.

The Hunter Auto Lock Company has been incorporated and will commence operations in Detroit, Mich., very soon. Incorporators, J. W. Hubbard, F. C. Hicks, etc.

The Reeves-Rigling Company, Hamilton, O., manufacturing hardware and other specialties, now in temporary quarters in the Morey building, will erect a new plant.

The Luitweiler Pumping Engine Company, Ames street, Rochester, N. Y., has commenced work on an addition to its plant which will accommodate about 500 more employees.

The Automat Company of America, Pittsburg, Penn., has been incorporated to manufacture vending machines. Capital, $25,000. Treasurer, J. O. Wallace, Pittsburg, Penn.

The A. A. Carlson Company, Chicago, Ill., has been incorporated with $2000 capital to manufacture metal ceilings, by A. A. Carlson, J. B. Morton and W. C. Carlson.

The Oil Power Company, New York, has been incorporated to manufacture oil engines,

etc. Capital, $100,000. Incorporators, L. Wygodsky, F. L. C. Keating, G. W. Bunnell, etc.

Automatic Appliance Company, Chicago, Ill., has been organized with $5000 capital to manufacture autos, motorcycles, bicycles, etc., by Stephen Velie, Samuel Breakstone, etc.

The Packard Motor Car Company is erecting a building at Broad and Wood streets, Philadelphia, Penn., which is to be equipped with machine shop and power-plant equipment.

The Anderson (Ind.) Cheese Cutter Company has been incorporated to manufacture cheese cutters. Capital, $10,000. Incorporators, E. P. Searle, F. M. Wilson, S. H. Searle.

The Hartman Electrical Manufacturing Company, Toledo, O., has been incorporated by R. M. Hartman and others to manufacture electrical apparatus of all kinds. Capital, $10,000.

The Porceliron Company, College Hill, Beaver county, Penn., has been formed to manufacture stoves and other articles. Capital, $25,000. Treasurer, M. N. Hurd, College Hill, Penn.

The Cleveland and Erie Machine Company, Cleveland, O., has been organized to manufacture and repair machines of all kinds by G. H. Williams, William Puddock, C. C. Williams, etc.

Atlantic Type Foundry, Philadelphia, Penn., has been incorporated to manufacture type and type metals. Capital, $10,000. Treasurer, C. Edward Dilkes, 1912 Arch street, Philadelphia.

The Star Manufacturing Company, Albert Lea, Minn., manufacturing power hammers and disk shapeners, will move plant to Waterloo, Ia., where new buildings are being erected.

Accurate Metal Company, Pittsburg, Penn., has been organized to manufacture structural or ornamental steel, iron and wire work. Capital, $5000. Treasurer, William C. Klein, Fair Haven, Penn.

The Rochester (N. Y.) Steel Castings Company has been incorporated with $50,000 capital to manufacture steel castings, etc. Incorporators, Fred C. Kimmel, P. V. Crittenden, I. C. Emery, etc.

The Reeves Pulley Company, Columbus, Ind., will start within a very short time, the manufacture of small stationary gasolene engines. Manufacturing facilities will be largely increased.

Parker Cup and Specialty Works, Parker's Landing, Penn., has been incorporated to manufacture pump cups and specialties. Capital, $5000. Treasurer, Alfred A. Schenck, Parker's Landing, Penn.

Hoban & Nepkin, 7855 to 7857 Railroad avenue, Chicago, Ill., have let the contract for a two-story garage and will equip it with new tools to do a custom business in repairing autos and trucks.

The Standard Electric Manufacturing Company, Chicago, has been incorporated with $2000 capital to manufacture electric fixtures and specialties by Earl O. Immel, G. N. B. Lowes, L. L. Falk.

Keystone Novo Company, Philadelphia, Penn., has been incorporated to manufacture iron and steel. Capital, $5000. W. Nelson Mayhew, 117 East Mount Pleasant avenue, Philadelphia, Penn., treasurer.

The Millar Automatic Chuck Company, Wilmerding, Penn., has been organized to manufacture chucks and other mechanical devices. Capital, $30,000. Treasurer, C. W. Millar, 613 Seventh avenue, Carnegie, Penn.

United Engineering Company, Toledo, O., has been organized with $10,000 capital to operate machine shops and do repairing on all kinds of machinery by Ernest Truman, August Tietz, Lawrence M. Rackerstraw, etc.

The Equipment Improvement Company, Cleveland, O., has been organized with $5000 preliminary capital, to design, manufacture and repair railroad rolling stock by Albert Waycott, H. Hughes Johnson, T. J. Moffett, etc.

Max Zeitler Engraving and Supply Company, Philadelphia, Penn., has been organized to manufacture stamping and embossing presses. Capital, $50,000. Treasurer, Chas. J. Hendler, 2560 North Seventeenth street, Philadelphia, Penn.

The Modern Electric and Manufacturing Company, Wilkinsburg, Penn., has been incorporated to manufacture gas and electric appliances and supplies. Capital, $20,000. Treasurer, Elliott Frederick, 8 Grace street, Pittsburg, Penn.

Belden Engineering Company, Pittsburg, Penn., has been organized to manufacture automobiles, trucks, motor boats, aëroplanes and motor vehicles. Capital, $25,000. Treasurer, Edward H. Belden, 720 Bessemer building, Pittsburg, Penn.

The Mather Spring Company, Toledo, O., has been incorporated with $100,000 capital to manufacture and sell all kinds of vehicle springs and automobile accessories by Gordon M. Mather, Robert C. M. Kergham, Rathburn Fuller, etc.

Armstrong, Wolf, Zimmerman Company, Pittsburg, Penn., has been formed to manufacture tools, supplies for mines, mills, railroads, bridges, breweries and buildings. Capital, $15,000. Treasurer, Madison S. Wolf, Sewickley, Penn.

The Geo. W. Mason Engineering and Manufacturing Company, West Middlesex, Mercer county, Penn., has been organized to manufacture water heaters and other mechanical contrivances. Capital, $10,000. Treasurer, Chas. M. Pierce, Sharon, Penn.

Electric Welding Company, Pittsburg, Penn., has been organized to manufacture appliances consisting of plates, bars, hooks, links for use in concrete or metal construction work and conducting a machine-shop business. Capital, $5000. Treasurer, R. A. Cummings, 6203 Stanton avenue, Pittsburg, Penn.

SOUTHERN STATES

The Mangum-Morris Company, Durham, N. C., has been organized to manufacture, repair and sell bicycles. Capital, $10,000. Incorporators, F. R. Mangum, J. B. Morris, R. O. Everett.

WEST OF THE MISSISSIPPI

W. J. McNeal, San Jose, Cal., has taken out a permit to build a foundry.

The Monroe machine shop, Portland, Ore., was partially destroyed by fire.

T. H. Thompson, Tulare, Cal., will build an addition to his automobile garage and machine shop.

G. J. Warren, Los Angeles, Cal., has had plans prepared for an automobile machine shop to be erected on South Hope street.

The Electric Auto Company, Long Beach, Cal., will build a new commercial garage and repair plant.

Fire destroyed plant of the Rotary Washing Machine Company, at St. Louis, Mo. Will be rebuilt.

The Reliance Machine Works, Pasadena, Cal., will erect a new plant and increase its present capacity.

The Golden Gate mine, Grass Valley district, Cal., is planning for the erection of a large machine shop.

The Tip Top Motor Car Company, Hood River, Ore., will build a new commercial garage and machine shop.

The Southern California Gas Company, Los Angeles, Cal., has taken out a permit to build a plant for meter repairs, etc.

The Northern Pacific Railroad will build new repair shops at Everett, Wash. Contract for the buildings has been awarded.

The Sherman Institute, Riverside, Cal., has had plans prepared for a new shop building. Superintendent Conser is in charge of this work.

N. B. Brooks, Goldendale, Wash., is having plans prepared for an automobile garage and machine shop. Modern equipment will be installed.

The high-school trustees, National City, Cal., contemplate the erection of a new manual-training school. Modern equipment will be installed.

The Northern Pacific Terminal Company, Portland, Ore., is planning for the erection of a large roundhouse in the Guild's lake district, Portland.

Manual-training equipment will be installed in the new school to be erected at Monrovia, Cal. Allison & Allison, architects, Los Angeles, Cal.

The Pomona (Cal.) Manufacturing Company, manufacturing valves, pumps, traction engines, etc., will build an addition to its plant and install new machinery.

In connection with public-parks improvement at Portland, Ore., a blacksmith shop and carpenter shop are to be erected on Jefferson street. E. T. Mische is superintendent of parks.

The International Rail and Metallic Tie Company, Phœnix, Ariz., has been incorporated by O. P. H. Michael and C. M. Wellsford, with a capital stock of $3,335,000. Offices will be maintained at Phœnix.

C. A. Quinn, Pasadena, Cal., will recommend to be bought by the City Board of Education, Pasadena, the complete equipment for a forge shop with thirty-six down-draft forges, motors, blowers, etc.

W. W. Martin, Pasadena, Cal., will recommend to be bought by the Board of Education a woodshop equipment consisting of forty benches, vises, dry-kiln equipment, glue and varnish room accessories, wood jointer, wood surfacer, sanding machine, grindstone and wood lathes.

J. O. Barnwell, Pasadena, Cal., will recommend to be bought by the City Board of Education a cupola and foundry equipment, machinery for gas engine laboratory, machines and equipment for an all-round machine shop, including about fifteen engine lathes of various sizes, wood lathes, wood-working benches, vises, etc., woodworking machinery, such as one surfacer, jointer, band saws, variety saws, etc., for pattern department.

CANADA

Edmonton Iron Works, of Edmonton, Alta., will build a big new plant.

The Doty Engine Works Company, of Goderich, will build a big new factory.

The Canadian Northern Railway will equip big new shops at McLeod, Alberta.

The Tallman Brass Company, of Hamilton, Ont., will build a big addition to its factory.

A. Grant will equip a big new garage and repair shops at 11 Constance street, Toronto.

The Canadian Pacific Railway will build a new roundhouse and shops at Neepawa, Ont.

The John Morrow Machine Screw Company, of Ingersoll, Ont., is building a big addition to its plant.

Part of the plant of the Ontario Rolling Mills Company at Toronto was wiped out by fire. New machinery is wanted immediately.

Palmer Brothers & Hemmins, of Vancouver, B. C., who will build a new railway to Cow-

ichan lake, will buy large quantities of machinery and equipment.

R. S. McCormick, chief engineer, Sault Ste. Marie, is calling for tenders for machinery and equipment in connection with the construction of 150 miles of new railway for the Algoma Central.

A. L. Young, vice-president of the Aikenhead Hardware Company, of Toronto, will have charge of a large new factory that is to be built immediately for the manufacture of steel factory sash and roof glazing.

FOREIGN

R. Faguelin, 3 Cite Magenta, Paris, France, would like catalogs of punching, shearing, stamping, bolt and rivet machinery, pneumatic hammers and drills.

General Manufacturing

NEW ENGLAND

Northboro, Mass., will extend its water system.

The Old Berkshire Mills, Dalton, Mass., will erect additions.

Westfield, Mass., will extend its water and sewer system.

The Fiske Rubber Company, Chicopee Falls, Mass., will enlarge its plant.

The L. L. Gilbert Bakery Corporation, New Haven, Conn., will install two small boilers.

The Massachusetts Wharf Coal Company will build a new coal pocket at Allston, Mass.

The shoe factory of Churchill & Alden, Brockton, Mass., was badly damaged by fire.

The Crane Paper Company has started to make enlargements on the plant at Dalton, Mass.

The village of Hyde Park, Vt., will install one pair of waterwheels to develop 150 kilowatts.

O. V. Hooker & Son, St. Johnsbury, Vt., contemplate installing a five-ton electric crane.

The French River Textile Company, Thompson, Conn., is about to install boilers and pumps.

The Baldwin Refrigerator Company, Burlington, Vt., is making additions to its factory.

The Geo. D. Emery lumber plant at Chelsea, Mass., was badly damaged by fire. Loss, $23,000.

Holyoke, Mass., will call for bids for installing a boiler house and steam plant at the city farm.

The Metropolitan Carriage Company, Bridgeport, Conn., has prepared plans for a new factory.

Julius Lane, Pittsfield, Mass., has purchased a site and will erect an ice-cream factory at a cost of $9000.

The Crown Manufacturing Company, South Attleboro, Mass., is building foundation for a new cotton mill.

American Emery Wheel Works, Providence, R. I., is excavating for a new plant on Waterman street.

Samuel Hathaway, New Bedford, Mass., has awarded contract for a shop containing a small boiler house.

Winoski River Power Company, Waterbury, Vt., has awarded contract for constructing a dam and power house.

Oliver M. Dean will erect a factory on Shrewsbury street, Worcester, Mass., for the manufacture of brooms.

The city of Waterville, Me., will build a high school containing chemical and physical laboratories and boiler house.

The Pritchard Shoe Company, Pittsfield, Mass., will build a four-story factory on site recently purchased on Eagle street.

U. S. Finishing Company, Pawtucket, R. I., is figuring plans for a power house containing boiler, turbine and pump rooms.

The city of Boston is receiving bids for furnishing a refrigeration plant using brine system and Corliss engine driven compressor.

The plant of the Wakefield Paper Box Company, at Wakefield, Mass., was recently destroyed by fire. Will be immediately rebuilt.

A horse-blanket mill is to be started at Franklin, Mass. W. A. Clark, Wm. Cutler and T. S. McDermott, all of Franklin, are promoters.

George W. Wooley & Son, Hartford, Conn., coffin manufacturers, will build a four-story addition to the factory recently purchased in Berlin, Conn.

The B. & R. Rubber Company, North Brookfield, Mass., will install three boilers and a tandem-compound engine for additional power to run its plant.

The Cushman Hollis Company, shoe manufacturers, Auburn, Me., is drawing plans for an addition to its factory to include cutting and stitching rooms.

Southington, Conn., has acquired control of the water system from the previous owner, the Southington Water Company, and will immediately extend the system.

The Norwich (Conn.) Belting Company has been organized with $50,000 capital to manufacture leather belting by Noah Lucas, Edmund W. Perkins, D. G. Perkins.

Permit has been issued to John E. McCarthy, treasurer and manager of the Superior Laundry Company, Springfield, Mass., for the erection of a new laundry at a cost of $34,000.

The plant of the Massachusetts Broken Stone Company, East Deerfield, Mass., consisting of boiler house, stone crusher and elevator, was destroyed by fire. Loss, $10,000. The plant had recently been equipped with air drills and air-compressing plant.

The Bristol & Plainville Tramway Company, Bristol, Conn., will install two steam turbine engines of 1000 horsepower each, alternating-current generators, three 300-kilowatt rotary converters, and a mecury arc rectifier in its power plant to replace machines now in use.

MIDDLE STATES

The Hemmeter Cigar Company, of Detroit, Mich., is erecting a seven-story factory.

The plant of the Specialty Printing Company, York, Penn., was destroyed by fire.

The Superior (Wis.) Box Company will establish a branch factory at Cincinnati.

Cleveland Woolen Mills, of Cleveland, Tenn., will build a branch plant at Chicago.

Fire destroyed the factory of the Diamond Cork Works, Brooklyn, N. Y. Loss, $200,000.

The Columbia Gas and Light Company, Cincinnati, Ohio, will erect a large new plant.

The Delaware & Hudson River Railroad will erect a big coal pocket at Schenectady, N. Y.

R. Askins, Pratt and Illinois streets, Indianapolis, Ind., will install a large new boiler.

The plant of the Eagle laundry, of Grand Rapids, Mich., was destroyed by fire. Will rebuild.

The plant of the Keil Wooden Ware Company, at Mellen, Wis., was burned. Loss, $10,000.

The grain elevator of Tribbey & Mullenhour, Plymouth, Ind., was burned. Loss, $15,000.

The General Chemical Company of New York will erect a large branch plant in East St. Louis.

Whitacre Fireproof Construction Company, Waynesburg, Ohio, will build a branch plant in Chicago.

Fire destroyed the power and lighting plant on John Arbuckle's farm at New Paltz, N. Y.

The Johnson Soap Works, Milwaukee, Wis., will install new automatic weighing machines in its plant.

City of Cleveland, Ohio, has the construction of a $2,000,000 electric-light plant under consideration.

The Tonawanda Valley Milling Company's plant, at Attica, N. Y., was destroyed by fire. Loss, $50,000.

The plant of the Monroe Binder Board Company at Monroe, Mich., was partially destroyed by fire.

The Edison Electric Company will build a $35,000 substation at 3442-44 Calumet avenue, Chicago, Ill.

A new boiler will be installed at the Empire theatre, Indianapolis, Ind. Heike Opera Company, proprietor.

The Johnson Optical Company, of Detroit, Mich., will locate a manufacturing branch in Saginaw, Mich.

The Philadelphia Sand-Lime Brick Company has started work on its new plant at Haddonfield, N. J.

The Gem Laundry Company, Indianapolis, Ind., will build an addition to its Indiana Avenue plant at once.

The large lumber mills of the H. N. Louds Sons Company, of Oscoda, Mich., were entirely destroyed by fire.

The plant of the Babcock Ice Company, Evansville, Ind., was damaged by fire to the extent of about $18,000.

The old car barns at Allentown, Penn., are being remodeled into a shop for the Lehigh Star Shirt Manufacturing Company.

The Philadelphia Screen Company is having an addition built to its plant at Fifty-sixth and Paschall avenue, Philadelphia.

The bakery of B. Schmidt, Harrisburg, Penn., one of the largest in that part of the State, was destroyed by fire. Loss, $80,000.

A refrigerator plant will be installed in the new West Side Market house, at Cleveland, O. A. B. Lea, director of public service.

An 11-story factory is to be erected for D. Auerbach & Sons, candy manufacturers, at Eleventh avenue and Forty-Sixth street, New York.

The Cleveland Cliffs Company is building a power dam and station on the Carp river at Marquette, Mich., to develop 10,000 horsepower.

The Lake Shore Saw Mills Company, Cleveland, Ohio, will erect a factory building to cost $20,000. New equipment will be installed.

M. C. Koch has purchased a piece of ground at Water and Snyder avenues, Philadelphia, on which he will have a cooperage plant erected.

A new power plant and laundry will be built at the Good Samaritan Hospital, Cincinnati, Ohio. G. W. Drach, architect, Cincinnati.

The city council of Lawrenceburg, Ind., has decided to increase the capacity of its municipal lighting plant and will install new equipment.

The Zemmer Company, Pittsburg, Penn., manufacturing chemical preparations, has purchased site for a new factory which will cost $50,000.

Worm & Co., Indianapolis, Ind., have incor-

porated to take over the meat-packing business of Albert R. Worm. Extensive additions will be made.

The Buckeye Electric Company, of Cleveland, O., manufacturing electric lamps, has taken out a permit for a factory building to cost $38,000.

The stockholders of the Salamanca Panel and Veneer Company, of Salamanca, N. Y., voted to rebuild the plant which was recently destroyed by fire.

The boiler house of the Germantown Ice Manufacturing Company at Belfield avenue and Haines street, Philadelphia, Penn., was destroyed by fire.

K. Kaufmann & Co., 169-171 Murray street, Newark, N. J., manufacturing traveling bags, have awarded contract for a three-story addition to their plant.

The factory of the Speck Chocolate Company, Evansville, Ind., was wrecked by fire. The loss is $42,000, of which amount $26,000 is on machinery.

Contract has been awarded for the erection of a new plant for the Castle Lamp Company, Elmira, N. Y. The concern makes oil and gas lamps for vehicles.

Schulzberger & Sons, meat packers, have purchased site at Forty-Third and Paulina streets, Chicago, Ill., and will make extensive additions to their plant.

The Mastic Wall Board and Roofing Manufacturing Company, Cincinnati, Ohio, will erect a two-story factory at Este avenue and the C. H. & D. Railroad.

Darling & Co., Center avenue and Forty-Fifth street, Chicago, Ill., will build a one- and three-story boiler house and buy equipment to cost over $100,00.

A new plant is being built on Twelfth street, extending from Pearl to Wood street, Philadelphia, Penn., for the Smaltz-Goodwill Company, shoe manufacturer.

The Bell Chemical Company, Indianapolis, Ind., has been incorporated with $50,000 capital to manufacture chemicals by J. W. Bell, F. X. Schaffer, B. E. Schaffer.

A permit has been issued to the Barrett Manufacturing Company to build a boiler house at the corner of Bermuda and Margaretta streets, Philadelphia, Penn.

The Arcade Furniture Company, Columbus, Ohio, has been organized with $10,000 capital to manufacture furniture. Incorporators, W. T. Pierson, Rudolph Purgrin, etc.

Cleveland Column Company, Cleveland, O., has been organized to manufacture all kinds of woodwork by Fred C. Acker, A. F. Wagner, John F. Vosper, etc. Capital, $10,000.

The Textile Manufacturing Company, of Chicago, Ill., has commenced the erection of a branch mill at Champaign for the manufacture of men's and women's underwear.

A new modern brewery will be built at Hamilton, Ohio. The entire capital, $75,000, has been subscribed by Frank Kerbel, Max Hemann, Louis Morner, et al., all of Hamilton.

The Crescent Trunk Company, Evansville, Ind., has been organized to manufacture trunks. Capital, $10,000. Incorporators, H. G. Becker, A. C. Hedderick, E. C. Kinke.

The Bogda-Neil Cooperage Company, Plymouth, Ind., has been incorporated with $3000 capital to manufacture cooperage material by F. H. Bogda, A. O. Neil, B. Bogda.

Maas & Waldstein, Inc., chemical-manufacturing concern, with a plant in Newark, N. J., and offices at 100 William street, New York City, will build a plant at Niagara Falls, N. Y.

The Hoosier Refrigerator Company, Peru, Ind., has been incorporated with a capital of $50,000 by W. S. Pond, W. A. Tucker, Harry F. Ader and others, to manufacture refrigerators.

The Hamilton (Ohio) Ice Delivery Company will increase its capacity 200 tons per day. Site has been secured for the new plant and modern ice-making machinery will be installed at once.

Power-plant equipment will be required for the 14-story building to be erected for the Buffalo (N. Y.) General Electric Company. Esenwein & Johnson, architects, of Buffalo, prepared the plans.

The Valley Shale Brick Company, Cleveland, Ohio, has been incorporated to manufacture brick, tile and other clay products, by H. H. Camp, H. H. Anderson, Hazel Kehres, etc. Capital, $25,000.

The three-story carriage plant of the J. Metzler & Sons Company, at 158-160 East Indiana street, Chicago, was partly burned. Loss to building and machinery, $10,000. Will be immediately replaced.

The United States Potash and Fertilizer Development Company, incorporated for $300,000 capital, will build a large plant at Amgordo, Mex., for the manufacture of fertilizer and cement. A. B. Johnson, Mt. Gilead, O., is president.

The power plant and a part of the works of the Mishawaka Woolen Manufacturing Company, South Bend, Ind., one of the largest concerns of its kind in the country, collapsed. The buildings will be rebuilt. The loss is estimated at $50,000, most of which is on the machinery.

SOUTHERN STATES

The Wheeling (W. Va.) Tumbler Company has commenced the erection of a plant in Warwood.

The plant of the South Pittsburg (Tenn.) Electric Light and Power Company was destroyed by fire. Will be rebuilt.

The Boone Electric Company, Boone, Ga., will build a new power plant; two 800-kilowatt turbine units will be installed. The boilers will consist of three 400-horsepower water tube, with chain grate stokers.

WEST OF THE MISSISSIPPI

The Henderson Carpenter Shop, Colusa, Cal., was destroyed by fire.

The Taber Saw Mill at Keokuk, Ia., was damaged to the extent of $100,000.

Mackenzie, Mann & Co., Duluth, Minn., are planning to erect a large grain elevator.

The Morton Salt Company will install more machinery in its plant at Hutchinson, Kan.

Mr. Meyer, of New Albion, Ia., is considering the erection of a cold-storage plant.

The Devils Lake (N. D.) Paper Company will erect a $250,000 plant at Sweetwater, N. D.

The Sauk Rapids (Minn.) Water Power Company will erect an electric-light and power plant.

The factory of the Twin City Box Company at Walker, Minn., was burned. Loss, $25,000.

G. W. McLaughlin, Monrovia, Cal., plans for the erection of a pumping plant near Elsinore.

The Duluth (Minn.) Show Case Company has awarded contract for the erection of a new factory.

The Standard Woodenware Company, Los Angeles, Cal., is having plans prepared for a new plant.

The Vinland Telephone Company, Kerman, Cal., will install a new plant and system in local districts.

A. C. Mason, San Francisco, Cal., is planning for the erection of a canning plant at Bakersfield.

W. D. Thomas, Petaluma, Cal., is planning to install a telephone system and plants in this district.

The Wilson Coöperative Creamery at Winona, Minn., was burned. Loss, $4500. Will be rebuilt.

Mr. Howe, manager of the creamery recently burned at Stevensville, Mont., will erect new plant.

Edward Poorman, Perris, Cal., will build a new creamery plant. Modern equipment will be installed.

The Utah Glazed Cement Pipe Company, Salt Lake City, Utah, has taken out a permit to build a new plant.

The city of Independence, Ore., will install a new waterworks system. Bonds for $25,000 have been voted.

The Quincy (Cal.) Creamery Company has been incorporated. The company will build a modern creamery plant.

The city of Bend, Ore., is planning for the installation of a sewer system. The city engineer is in charge.

The city of Watsonville, Cal., is planning to install a new waterworks system. Bonds for $110,000 will be voted.

The Missouri Candy Company, St. Louis, Mo., will erect a $13,000 addition to its plant on North First street.

The State Board of Control, Olympia, Wash., will erect a new power plant at the Veterans' Home, Port Orchard.

The Klamath Falls (Ore.) Light and Power Company is planning to install a new pumping plant in West Klamath Falls.

The Anaheim (Cal.) Sugar Company contemplates the erection of a new sugar factory near Calexico, Imperial Valley.

The Union Oil Company, Los Angeles, Cal., will increase the capacity of its oil-refining plant near Fullerton in the near future.

The Cascade Lumber Company, North Yakima, Wash., is in the market for water-distilling machinery of the latest type.

H. J. Mercer, Los Angeles, Cal., beekeepers' equipment, has taken out a permit to build an addition to his boiler plant.

The Washington Water Power Company, Spokane, Wash., is planning to install a lighting and power system at Lacrosse.

The Central Iowa Egg and Poultry Company at Atlantic, Ia., will erect a modern artificial-ice plant of 30 tons daily capacity.

George F. and S. C. Purdy, J. L. Mears and Charles Miller, of Geyser, Mont., are interested in the erection of a cement mill.

The Idaho Glazed Concrete Pipe Company, Boise, Idaho, will build a plant for the manufacture of its specialty at Baker, Ore.

The United States Gypsum Company, Blythe, Cal., will build a large plaster mill. Modern equipment will be installed throughout.

The Missouri Valley Water Company will erect a bottling and filtering plant at Mobridge, S. D. W. L. Buckow and C. B. Ross, proprietors.

The Silica Brick Company, Sacramento, Cal., is planning to make improvements and additions in its plant. About $25,000 is estimated cost.

C. G. Winters, Wells, Nev., is planning to install a telephone plant and system in the Rattlesnake Springs district. A franchise has been granted.

The Home Telephone Company, San Diego, Cal., is planning for extensions and improvements in its plant and system. About $35,000 will be expended.

The Washington Street school, Fresno, Cal., is having plans prepared for a power-house addition to its heating plant. J. M. Saffell, architect, Fresno.

Power-plant equipment will be required in the three large office buildings and hotel

to be erected by the Metropolitan Building Company, Seattle, Wash.

The Oregon-Washington Railroad and Navigation Company is having plans prepared at Chicago, for a large coaling station to be erected at Seattle, Wash.

The Washington Steel and Iron Company, Spokane, Wash., is planning to install an electric-lighting system at Leavenworth. A franchise has been granted.

The Orange Heights Fruit Association, Corona, Cal., contemplates the erection of an addition to its packing house. Modern equipment will be installed.

The Oroville (Cal.) Furniture Company has been incorporated, and is planning for the erection of a plant. R. S. Powers and J. J. Hamlyn are interested.

The Interstate Consolidated Telephone Company, Plummer, Idaho, is planning to install a new plant and system in this section. A franchise has been granted.

A complete new power plant will be installed in the Jamieson building, Spokane, Wash. Plans are being prepared. Norman R. Totten is agent for this property.

The Northern Idaho & Montesano Power Company, Newport, Wash., plans to install an electric-lighting system at Priest River, Wash. A franchise has been granted.

The Portland (Ore.) Railway Light and Power Company has purchased property at East Twenty-eighth street, and will erect large and thoroughly modern car barns.

The Oakesdale (Wash.) Home Telephone Company has been incorporated by C. G. Mead and A. F. Woodward. A system and plant will be installed in this district.

The Soda Bay Land Company, San Francisco, Cal., is planning to install a bottling works plant, a water system, and an electric-lighting system on Clear Lake, Cal.

The Richard Abenheim Company, Mababi Ranch, near Douglas, Ariz., is planning for the erection of a furniture factory. Modern woodworking machinery will be installed.

The Rawhide Queen Coalition mine, Rawhide, Nev., is planning to install new electric-operating machinery to take the place of the gasolene-engine equipment now being used.

Armour & Co., Chicago, Ill., has acquired property on Seventh street, San Diego, Cal., and plans for the erection of a large cold-storage plant. About $75,000 will be expended.

The Monterey County Gas and Electric Company, Monterey, Cal., is planning for improvements and extensions in its system. A franchise covering the entire county has been asked.

The Cedar Rapids and Iowa City Railway and Light Company, Cedar Rapids, Iowa, will install two new boilers, one turbine and make extensive improvements to its electrical equipment and building.

Dr. Fred S. Pearson, head of the Mexico-Northwestern Railroad, El Paso, Tex., contemplates the erection of lumber mills in this vicinity to use the timber of his Sierra Madre forests, Chihuahua.

The Sunset Telephone and Telegraph Company, Tacoma, Wash., will build a new substation in this city. The company is also having plans prepared for a new station to be erected at South Bend.

The Bremerton & Charleston Light and Fuel Company, Bremerton, Wash., contemplates the installation of a power and lighting system at Port Orchard, Wash. A franchise has been asked.

The Resoleum Products Company, Riverside, Cal., has acquired the Riverside fruit-canning plant. The company will increase the capacity and install new machinery. About $20,000 will be expended.

W. J. Hill, Spokane, Wash., has acquired silica property near Dartford, and is planning for the erection of a plant to manufacture this product into soap and specialties. Modern machinery mill be installed.

The Pacific Telephone and Telegraph Company, Portland, Ore., is planning to make improvements and additions to its plant at Klamath Falls, Ore. New equipment will be installed. C. H. Moore is district superintendent.

The Mokelumne River Power Company, San Francisco, Cal., recently incorporated by LeGrand Brown and A. M. Sherman, has acquired power sites in Amador and Calaveras counties, and plans for the erection of power plants.

The Sacramento Valley Power Company is planning to extend its system in the Shasta mining district about 50 miles; new power plants are contemplated in this section. Herbert Fleishhacker, San Francisco, Cal., is head of this company.

The Western Malting and Distilling Company, Los Angeles, Cal., recently incorporated, is having plans prepared for a plant for the manufacture of yeast and vinegar. Modern equipment will be installed; about $25,000 will be expended upon buildings. J. W. Evans is head of this company.

CANADA

Cornwall, Ont., will extend its waterworks system.

Saskatoon, Sask., will spend $300,000 extending its sewage system.

Niagara Falls, Ont., will spend $100,000 extending its sewer system.

Yorkton, Sask., will make important extensions to its waterworks system.

The Canadian Flax Mills Company will equip a big new plant at Drayton, Ont.

The Empire Manufacturing Company, of London, Ont., will install a big new smelting plant.

The Goodyear Tire and Rubber Company, of Bowmanville, Ont., will greatly increase its plant.

The Hawes Von Gal Hat Company, of Niagara Falls, will buy a large quantity of new machinery.

The Canadian Tungsten Lamp Company will build a very large new factory at Hamilton, Ont.

The Flexible Conduit Company, of Penn Yan, N. Y., will open a branch factory at Guelph, Ont.

The American Cyanide Company is building a new $70,000 power plant at Niagara Falls, Ont.

The British Columbia Portland Cement Works will build an immense new plant at Princeton, B. C.

Gordon Ironsides & Fares, of Winnipeg, will equip a new $150,000 modern packing plant at Moosejaw, Sask.

The Toronto Niagara Power Company will buy $500,000 worth of new machinery for its new power house at Niagara Falls, Ont.

The Ontario & Manitoba Flour Mills Company, of Ottawa, will equip its big new mill at Sudbury, with electrical machinery.

A large quantity of machinery, destroyed at the Standard mine in the Porcupine, New Ontario, will be replaced. Loss, $25,000.

The Quebec & Saguenay Railway Company, of Quebec, will build big extensions to its line and much new equipment will be needed.

Twenty five thousand dollars worth of equipment will be purchased for the new public works and mines laboratory at Halifax.

The plant of the Vipond Mining Company, in the Porcupine, New Ontario, was badly damaged by fire. New machinery will be purchased.

The Canadian Northern Railway Company will install a large amount of machinery at Port Arthur, Ont., for handling coal by electricity.

Fire destroyed the big Riordan Pulp and Paper Mills at Calumet, Que. Loss over $1,000,000. New machinery for bigger mills will be bought at once.

Fire did $25,000 damage to the mining machinery of the Preston East Dome mine, in the Porcupine district, New Ontario. New equipment will be secured as soon as possible.

MEXICO

The Las Palomas mines, Altar, Sonora, Mex., will build a new electrical-power plant; a new pumping plant will also be installed.

J. G. McNab, Mexico City, Mex., is chief engineer for large interests which will build a power plant near Santa Rosalia, Chihuahua, Mex., to serve this entire district. Work on a dam has commenced.

MINING

Stace Brothers, National, Nev., contemplate the erection of a new milling plant.

The Florence Goldfield Mining Company, Goldfield, Nev., will install new milling machinery.

The Lightner mine, near Redding, Cal., will install a new and thoroughly modern milling plant.

The Guadalupe mine, near Inde, Durango, Mex., contemplates the enlargement of its milling plant.

The Liza Ray mine, near Vontrigger, Cal., will remodel its milling plant and install new machinery.

The Miami (Ariz.) Copper Company is planning to increase the capacity of its concentrating plant.

The Lawrence mine, near Clarks Fork, Idaho, contemplates the erection of a 25-ton concentrator.

The Centennial mine, near Georgetown, Colo., is planning for the erection of a 50-ton milling plant.

The Jack White Mining Company, Murray, Idaho, is planning for the erection of a concentrating plant.

The Golden Gate mine, Grass Valley district, Cal., will increase the capacity of its stamp mill by ten stamps.

The Guerrero Mining and Milling Company, near Taxco, Guerrero, Mex., will install a new cyanide plant.

The Gold Dollar Mining Company, Crown Hill district, S. D., is planning for the erection of a milling plant.

The Agua mine, operated by Husted & Austin, Durango, Mex., is planning for the erection of a reduction plant.

The Bolanos mine, near San Dimas, Durango, Mex., contemplates the erection of a concentrating and cyanide plant.

The Bingen Ore and Smelting Company, Idaho Springs, Colo., is planning for the erection of a 50-ton smelting plant.

F. L. Magneson, San Jose, Cal., operating near Lappen cañon, is planning to increase the capacity of his stamp mill.

The Portilla mine, near Santiago Papasquiaro, Durango, Mex., will increase the capacity of its stamp mill from 20 to 60 stamps.

The Granite Basin Mining and Milling Company, Buck Ranch, near Oroville, Cal.,

contemplates the erection of a milling plant in the near future.

The South Des Moines Coal Company, at Dts Moines, Ia., will install modern coal mine with electric power for hoisting and drilling. A. C. Bondurant, president.

Business Items

The business of the National Machine Tool Company, of Cincinnati, Ohio, has been purchased by Herman E. Holz, who will continue the manufacture of keywaying tools and oil-grooving cutters.

Geo. L. Markland, Jr., is now president of the Philadelphia Gear Works; Robt. J. Coulter, vice-president; Russell C. Ball, secretary. Geo. B. Grant retains his connection with the company as mechanical engineer.

Trade Catalogs

Niles-Bement-Pond Company, 111 Broadway, New York. Catalog. Planers. Illustrated, 26 pages, 9x12 inches.

The Carlyle Johnson Machine Company, Manchester, Conn. Bulletin No. 100. Johnson cutoff coupling friction clutch for marine engines. Illustrated.

T. R. Almond Manufacturing Company, Ashburnham, Mass. Pamphlet. Almond flexible casing for speedometer shafts. Illustrated, 8 pages, 5x7½ inches.

International Oxygen Company, 68 Nassau street, New York. Catalog. Oxygen and hydrogen cutting and welding apparatus. Illustrated, 16 pages, 6x9 inches.

The Bristol Company, Waterbury, Conn. Condensed Catalog No. 160. Bristol recording instruments for pressure, temperature, electricity, speed, time, etc. Illustrated, 64 pages, 8½x10½ inches.

General Electric Company, Schenectady, N. Y. Bulletin No. 4818. Couplings. Illustrated, 10 pages, 8x10½ inches. Bulletin No. 4832. Computing pole generators. Type DLC. Illustrated, 6 pages, 8x10½ inches.

Forthcoming Meetings

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Second hand lathe, 16 feet between centers, 24-inch swing over carriage. Box 116, American Machinist.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 900 G St., Washington, D. C. Write for Inventor's Handbook.

Competent mechanical engineer, N. Y. City, designs special and automatic machines and tools for all kinds of duplicate work; highest references. Box 852, Amer. Machinist.

General machine and tool and die work of every description solicited at hour rate or contract estimates furnished. James T. Carroll, 526 Hunter's Point Ave., Long Island City, N. Y.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Wanted—Every mill, factory, foundry and machine shop in the United States which is for sale, as our experience of twenty years in the business gives us unequaled facilities for selling them; correspondence invited. Nicholson & Co., Factory Brokers, 150 Broadway, New York.

Wanted—Party or parties to buy outright or to take a license on the basic patents on the only automatic continuous solids and filter press in existence, pressing between cloths, loading and unloading automatically; pressing can be regulated to any extent with or without hydraulic or screws, or it can be run as an ordinary press at the same time doing away with the trouble of taking apart the machine to run over the cakes; manufacturers will require no special machinery; the press can be seen in operation and a thorough investigation made of its many possibilities. K. S. Berrigan, sole owner, 136 North Centre street, Orange, N. J.

An unusual opportunity is offered to a machine shop properly equipped to take up the manufacture of a line of machine tools which have special features of advantage, and should be interesting to all users; the shop equipment required would be classed medium to large, with the usual range of milling machines, screw machines, gear cutters, grinders, etc.; location preferred within 100 miles of New York; capacity to employ 200 to 300 machinists, which can be increased 50 to 100 per cent.; arrangements could be made on a contract basis, or would undertake to organize and manage a shop for this line only, if suitable plant with moderate amount of capital was available; this is a straight business proposition and correspondence is solicited from those really interested as to location and present equipment, space for enlargements, etc. Box 118, American Machinist.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Experienced rate fixer; man competent to take full charge of rate department; must have knowledge all classes machinery operations, large and small work; in reply state salary required and when disengaged. Box 102, American Machinist.

Chief draftsman for mechanical department of large corporation building a general line of cranes, coal and ore handling machinery, etc.; must be a man of large experience and have good knowledge of structural work; position permanent at good salary; location, northeast. Box 61, American Machinist.

CONNECTICUT

Wanted—Detail draftsman of two or three years' experience for mill engineering work. Engineering Dept., American Thread Co., Willimantic Mills, Willimantic, Conn.

INDIANA

Wanted—A man who has made gearing and gear cutting a specialty; one who understands gearing technically; interesting proposition for right party. Box 111, Am. Mach.

IOWA

Wanted—General superintendent, capable of taking complete charge of thriving and fast growing factory making general line of steel stampings; location in good mid-western city; runs about thirty punch presses, with full supplemental equipment, employs seventy operatives; must be first class executive, good disciplinarian, able to handle labor, and to turn out the work; only thoroughly equipped and experienced man need apply; place demands a good man and will pay for him, but wants full value received; no beginners or failures wanted, but the chance of a lifetime for the right man; state fully and clearly your qualifications, experience, age and salary desired; all will be held strictly confidential. Address "X," Box 50, Am. Ma.

KENTUCKY

The Universal Stenotype Company, Owensboro, Ky., organizing factory for production of writing machine, requires services of toolmakers, die makers, machinists, screw machine men and punch press men; only applications from mechanics having best of references will be considered; young men preferred; fine opportunity for rapid advancement. Address "Superintendent," enclosing references.

MASSACHUSETTS

Speed boss wanted, a first class, thoroughly practical man that has had experience as foreman or speed boss in an engine or pump plant; this man is wanted to go right on the machines and show the operatives, and is not wanted as an office statistician. Write very fully to Box 100, American Machinist.

Draftsman Wanted—An experienced mechanical draftsman, preferable with a technical education, or a number of years' practical shop experience, by a large manufacturing concern in Massachusetts; state age, experience and salary expected by addressing "Chief Draftsman," Box 109, Amer. Mach.

Wanted—First class tool designer to take charge of tool drafting room of manufacturing company; must be experienced and competent in design of jigs, fixtures, punches, dies and other special tools used for quantity production of light machine parts on an interchangeable basis; give technical education, detailed shop and office experience, places and periods of employment, references, age and salary expected. Address "D," Box 1574, Springfield, Mass.

MICHIGAN

Foreman wanted for light hardware manufacturing in department of stamping and automatic screw machines; give age, experience, references and wages required. Box 96, Am. M.

Wanted—Foreman for grinding department in roller bearing manufacturing plant in Mid-

die West; must himself be an expert operator and able to work to very close limits; also able to get maximum output out of department and keep it coming; give detailed experience, salary and references in first letter. Box 123, AMERICAN MACHINIST.

Wanted—Gear expert; a large corporation will employ a first class bevel gear man who understands thoroughly the technical as well as the practical side of bevel gear production; must be able to produce highest grade of hardened gears; liberal salary to man who can produce the goods; state age, experience and salary expected. Address Box 113, AM. M.

MINNESOTA

Wanted—First class foreman to take charge of manufacture of marine gasolene engines; one who thoroughly understands the handling of tools and the turning out of work in first class order; steady employment and good wages will be paid to the right man. Apply to the Campbell Motor Co., Wayzata, Minn., stating experience.

MISSOURI

Experienced designer on general machinery; give reference, experience, education and salary expected. Box 114, AMER. MACHINIST.

NEW JERSEY

Wanted—At once, mechanical draftsman for cranes; one with experience on structural work preferred; state salary and experience. Sprague Electric Works, Bloomfield, N. J.

We will have openings for machinists and toolmakers during July; mail your application, giving references and wage at last place. Crane Motor Car Company, 96 West Seventh street, Bayonne, N. J.

Instructor wanted to teach machine shop practice in well known trade school; fine, modern equipment of tools and machines; salary $900 for first year; excellent opportunity for young man who wishes to obtain teaching experience; general education not as important as high character, adaptability, thorough knowledge of machine shop practice and courtesy and squareness in handling men; state fully about yourself in regard to the above points and name three or four references to whom we may write If you have had promotions of any kind tell us of them. Box 115, AMERICAN MACHINIST.

NEW YORK

Wanted—Draftsmen, experienced on tools, jigs and fixtures for the manufacture of small interchangeable parts; state age, experience in detail and salary expected. Box 124, AM. M.

Wanted—Salesman to handle a complete line of planing mill exhausters, steel plate fans, blowers, dust collectors, ventilators, etc., on a commission basis; liberal terms and choice of territory to reliable parties. Address Box 107, AMERICAN MACHINIST.

Wanted—Machinists wanted. lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—Stenographer, having knowledge of steel business, competent to handle simple correspondence without dictation; opportunity for right person to advance to position of private secretary. Address, stating age, experience and salary expected, "Steelmaker," AMERICAN MACHINIST.

Salesmen—Manufacturers of a well known special machine used by the metal working trades seek the services of competent salesmen as field representatives to handle this machine exclusively; ability to make good on large propositions is essential, and familiarity with turret lathe practice desirable. Address Box 108, AMERICAN MACHINIST.

Wanted—A young man in the machine tool business, selling department, location New York; must be a fairly good draftsman; general mechanical training advantageous; moderate salary with good chance for advancement; the right man should make this position valuable. Apply by hand written letter, giving age and general statement of experience. Box 117, AMERICAN MACHINIST.

Wanted—Machinery salesman, live and energetic, with theoretical and practical experience in gear cutting, for selling high grade, well known line of modern gear cutting machines; first class opportunity for capable hustler; state age, salary desired, former experience and territory covered; only men with thorough experience in gear cutting line will be considered. "S. G.," AMER. MACHINIST.

NORTH CAROLINA

Wanted—German-American mechanic, who has some knowledge of mechanical drawing as foreman of machine shop in small town; state experience, present position, age and salary expected. S. Parker, Pine Town, N. C.

OHIO

Wanted—High class machinist for tool room. Box 119, AMERICAN MACHINIST.

Wanted—An experienced operator on automatic screw machine; must be capable of estimating on work; also designing the tools for same. Box 97, AMERICAN MACHINIST.

Wanted—Assistant foundry foreman in grey iron foundry; state experience, class of work, former employer, age, salary expected and when free to take position. Box 103, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Wanted—General superintendent to take charge of a sheet metal stove shop employing 1000 men; must be thoroughly familiar with sheet metal work, factory management and equipment; he must be strictly sober, efficient and have good constructive ability, and be able to furnish first class references as to character, experience and ability; only those who can fully qualify need apply. Address "Supt.," Box 80, AMERICAN MACHINIST.

PENNSYLVANIA

Wanted—Instructors in mechanical engineering, in electrical engineering and in mechanical drawing at an eastern institution; applicants must be graduates of technical schools, preferably with one or two years' practical experience. Box 78, AMER. MACH.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wanted—General superintendent for manufacturing plant established nearly thirty years, whose product is standard and comprises the largest line of its kind in the world; light and medium manufacturing, interchangeable parts and where the production of volume, decreased costs and the proper layout of machinery and work are essential; a practical experienced man to be in charge of factory, production and the manufacturing generally; only experienced men of thoroughly good character and habits will be considered and who are capable of handling men, introducing improved methods, and thoroughly familiar with cost systems, stock systems and modern shop practice; state references, experience, past and present employment, age and salary expected in first letter. Box 76, AMERICAN MACHINIST.

VERMONT

Salesmen—We want several salesmen to sell Gridley automatics; applicants should give full particulars as to experience and state salary expected. Windsor Machine Co., Windsor, Vt.

VIRGINIA

Wanted—A first class draftsman, one having experience in elevator designing and layouts preferred; state experience, age and salary expected. Westbrook Elevator Company, Danville, Va.

WASHINGTON

Wanted—An assistant foreman, young and uptodate, who understands sawmill and engine work, to have charge of floor and bench hands; from 15 to 30 men under him; good job for the right man. Address Sumner Iron Works, Everett, Wash.

WISCONSIN

Wanted—Foreman for machine shop department, fifty operatives, near Chicago; we want a man about thirty-five years of age that can show results. Box 125, AM. MACH.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Foreign sales manager, American, with eleven years' selling experience in Europe, speaking French and German, wishes to make connection with manufacturer as foreign sales manager or representative, located abroad; special experience in machinery and kindred lines. Box 99, AMER. MACHINIST.

MAINE

Manager or superintendent of machine shop, forge or foundry; first class references. Box 996, AMERICAN MACHINIST.

MASSACHUSETTS

An experienced executive and practical mechanic, competent draftsman and designer of tools and special machinery, desires responsible position. Box 120, AMER. MACHINIST.

Experienced machine tool salesman with extensive acquaintance in the East and Middle West, wants position; can show a splendid record and give best of references. Box 84, AMERICAN MACHINIST.

Hustling, uptodate machine shop superintendent, with 20 years' varied experience, manufacturing special and general machinery, wants position; location not important; best of references. Box 85, AMER. MACHINIST.

NEW YORK

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Designer, 30, ten years' experience special machinery, tools, etc., also experimental work, desires position in New York City. Box 101, AMERICAN MACHINIST.

Position as foreman designer on tools, jigs and special machinery; have had ten years' practical experience; wish to engage with permanent concern. Box 122, AMER. MACH.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Mechanical engineer, German graduate, age 32, expert designer of automatic, conveying and elevating machinery, labor saver and systematizer, desires position with manufacturing concern. Box 106, AMER. MACHINIST.

Superintendent, 14 years in charge of manufacturing and building high class automatic machinery and machine tools; good organizer of shop system that will show good profits; New York or New Jersey preferred. Box 83, AMERICAN MACHINIST.

Manager or general superintendent; can make the price, sell output, improvements permanent, broad lines, individual effort system for help, direct through strong organization, practical experience; no trifling; shop or foundry; now employed. Address "Executive," AMERICAN MACHINIST.

OHIO

First class plater, polisher and buffer who has had 20 years' experience and desires to make a change; can furnish good reference. "L. F. K.," AMERICAN MACHINIST.

Wanted—Position by tool room foreman; A-1 mechanic in punch and die, also drop forge die work, open for engagement August 15. Box 121, AMERICAN MACHINIST.

Chief tool designer or master mechanic desires making a change in the near future and invites correspondence from parties, requiring the services of such a man; specialist in uptodate production methods and cost reduction in making interchangeable machinery. Box 86, AMERICAN MACHINIST.

PENNSYLVANIA

Draftsman and tool designer with shop experience will be open for position about August 5; age 27. Box 110, AMER. MACHINIST.

Wanted—Responsible position by an expert tool and instrument maker, 32 years old, married, with 15 years' experience in fine tools, dies, instrument, experimental and model work, inventive and executive ability; any one desiring the service of a man well uptodate in the manufacture of fine interchangeable parts will find it to their advantage in answering this ad. to Box 112, AM. MACH.

FOR SALE

Machine shop for sale in a manufacturing town in New Jersey; saw tooth roof and steam heated; lathes from 9 inches up to 42 inches; good chance for one or two bright mechanics to invest a few thousand dollars; an excellent opening for automobile shop and foundry along with present business. Box 88, AMERICAN MACHINIST.

For Sale—Outright, or will license to one or more, the basic patents on the only automatic, continuous, solids and filter press in existence, pressing between cloths, loading and unloading automatically; pressure can be regulated to any extent without or with hydraulic or screws, or it can be run as an ordinary press; at the same time doing away with the trouble of taking the machine apart to remove the cakes; manufacturers will require no special machinery; the press can be seen in operation and a thorough investigation can be made of its great possibilities. K. S. Berrigan, sole owner, 136 North Centre street, Orange, N. J.

Talks With Our Readers

By The Sales Manager

Have you ever considered the power of advertising and the wide variety of its modern applications?

About a month ago several of the churches in a certain district of Brooklyn combined to hold union services for a number of weeks. Only one church in the neighborhood was not included, and the attendance at this one quickly dropped to a very few staunch standbys.

The pastor saw that something must be done to meet the competition so he secured the services of a very fine contralto and advertised that she would sing in his church every Sunday night.

Since then he has had to have rows of chairs put in back of the regular pews.

Two months ago a small church in Montclair spent $60 in advertising. The attendance was doubled and the increase in the collections in two Sundays more than paid for the advertising.

Advertising is used in almost every field of work today.

It has elected candidates to office, carried bond issues at the polls, raised money for charity, stopped strikes, populated towns, cities and states.

Advertising is one of the most powerful of modern institutions. It is our great National antidote for stagnation.

Suppose some manufacturer today should stop improving his product and let it fall behind the times, and suppose his rival kept on making all the improvements that progress, new discoveries and new ideas made possible.

How long would the first be able to stay in business?

Not many moons—and why?

Because competitive advertising would soon point out the widening chasm between the old, stagnant product and the up-to-date, improved article.

Advertising is a goad—in its lexicon there's no such word as "quit."

It forces the whole manufacturing world to keep on the jump—to do new things—to evolve new ideas—to better quality—to make honest prices.

To those who conscientiously use advertising as a salesman, it brings good business returns.

To those who "read, mark and inwardly digest" advertising, it gives the power and ability to buy wisely, reasonably and profitably.

The rule must work both ways, or it won't work either.

"A good article, good advertising, good results for the buyer"—that's the formula—and you can't supply a "bad" for any one of those three "goods" and get away with it!

Cultivate your acquaintance with the advertisements in your paper—they are put there at great expense, for your benefit.

* * *

Only reliable products can be continuously advertised.

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Fosdick Mach. Tool Co..... 32
Gould & Eberhardt..... 35
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Hoefer Mfg. Co.....125
Leland & Co., W. H.....123
Manning, Maxwell & Moore...128
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New Haven Mfg. Co..... 86
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Pratt & Whitney Co....2 and 48
Prentice Bros. Co 29
Rockford Drilling Mach. Co..131
Sellers & Co., Wm..... 36
Sibley Machine Tool Co.....122
Sigourney Tool Co.....123
Sloan & Chace Mfg. Co..... 87
Taylor & Fenn Co.....123
Washburn Shops.....117
Wiley & Russell Mfg. Co..... 95
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Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co....2 and 48
Slocomb Co., J. T..... 94
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U. S. Electrical Tool Co.....114

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Lincoln-Williams Twist Drill Co. 126
Pratt & Whitney Co....2 and 48
Whitman & Barnes Mfg. Co.. 74

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Ingersoll-Rand Co.....105
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Drills, Ratchet
Armstrong Bros. Tool Co.....126
Boker & Co., Hermann.....129
Cleveland Twist Drill Co....136
Curtis & Curtis Co..... 93
Detroit Twist Drill Co..... 80
Parker Co., Chas.....115
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Standard Tool Co..... 26

Drills, Rock
Chicago Pneumatic Tool Co..104
Ingersoll-Rand Co.....105

Drills, Twist
Pratt & Whitney Co....2 and 48

B & S CUTTER GRINDING MACHINES

Our line of cutter grinding machines is extensive and embraces machines to handle all styles and varieties of cutters.

No. 2 Cutter Grinding Machine

This machine takes cutters to 6″ in diameter and 6″ in length. Thin milling cutters or saws to 24″ in diameter can be accommodated.

No. 3 Universal Cutter And Reamer Grinding Machine

This machine differs from the No. 2 mainly in being capable of taking a greater variety of cutters. It will sharpen straight and taper, shell or shank reamers, edge and bevel cutters of any angle, straddle and face mills, cotter and hollow mills and straight or taper milling cutters, cut either straight or spiral, with holes or shanks.

No. 2 Cutter Grinding Machine

No. 13 Universal And Tool Grinding Machine

In addition to the wide range of cutters and reamers which can be ground, this machine is adapted for a wide range of cylindrical work. By the addition of attachments the machine can be adapted for internal and surface grinding, disk grinding, radial grinding, hob grinding, as well as for the grinding of convex and concave cutters whose teeth are not formed and require to be ground on the periphery.

No. 23 Gear Cutter Grinding Machine

Takes gear cutters to 8″ in diameter, $2\frac{1}{4}$″ thick and $1\frac{1}{2}$ diametral pitch. All cutters are ground with their tooth faces radial and equidistant.

We have circulars giving full descriptions of each machine. Send for one or all of them.

BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I., U. S. A.

Dynamometers, Electric
General Electric Co.....118
Sprague Electric Co.....119

Dynamos
Burke Electric Co.....120
Electro Dynamic Co.....120
Garwood Electric Co.....119
General Electric Co.....118
Holtzer-Cabot Electric Co....120
Reliance Electric & Engr. Co.120
Roth Bros. & Co.....120
Sprague Electric Co.....119
Triumph Electric Co.....120
Westinghouse Elec. & Mfg. Co.119

Electrical Supplies
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Garwood Electric Co.....119
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Harrington, Son & Co., Edwin. 89
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American Emery Wheel Wks. 117
Dessau's Sons, S.....116
Diamond Saw & Stamping Wks.103
Dickinson, Thos. L..... 50
Reed Mfg. Co.....115
Safety Emery Wheel Co.....117
Springfield Mfg. Co.....126
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Vitrified Wheel Co.....117

Emery Wheels
See Grinding Wheels.

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Glidden Varnish Co..... 100

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Hart & Cooley Co..... 90

Engineers, Mechanical or Electrical
Link-Belt Co..... 75
Merritt, Jos..... 50
Weeks, C. S..... 81

Engines, Automobile
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Franklin Mfg. Co..... 96

Engines, Gas and Gasolene
Automatic Machine Co..... 59
Grant Mfg. & Mach. Co..... 90

Engines, Steam
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Sprague Electric Co.....119
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Fans, Exhaust
Garwood Electric Co.....119
General Electric Co.....118
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National Tube Co.....102

Fittings, Hydraulic
Watson-Stillman Co.....126

Fittings, Steam
National Tube Co.....102
Walworth Mfg. Co..... 50

Flanges
Dart Mfg. Co., E. M.....103
Jefferson Union Co.....105
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Marshall & Huschart Machry. Co..... 80
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Besly & Co., Chas. H..... 85
Diamond Machine Co.....129
Gardner Machine Co.....116
Ransom Mfg. Co.....115
Rowbottom Machine Co.....117
Safety Emery Wheel Co.....117
Taylor & Fenn Co.....123

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Grant Mfg. & Mach. Co..... 90
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Pratt & Whitney Co....2 and 48
Rivett Lathe Mfg. Co.....135
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Garvin Machine Co..73 and 106
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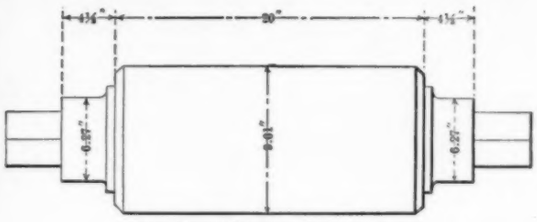
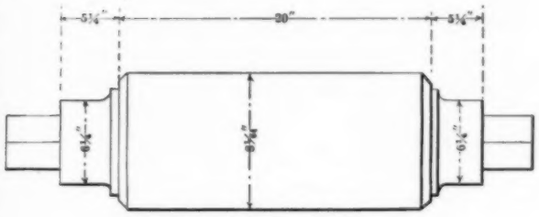
Leland & Co., W. H.....123
McCabe, J. J.....78 and 88
Morse Twist Drill & Mach. Co. 59
Newark Gear Cutting Machine Co.....114

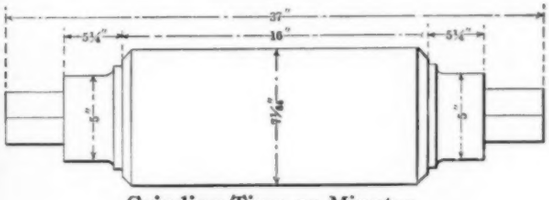
LANDIS SERVICE—LANDIS METHODS



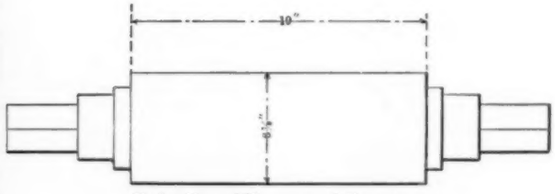
Grinding Time 1¼ Hours.
Material, Chilled Gray Iron.
Stock Removed, .030″ Diameter.



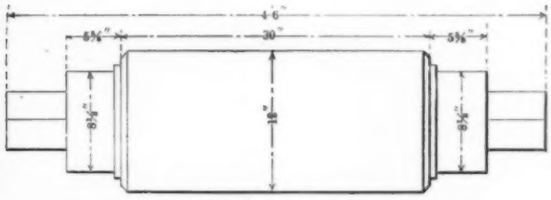
Grinding Time 1 Hour.
Material, Chilled Gray Iron.
Stock Removed, .030″ Diameter.



Grinding Time 50 Minutes.
Material, Chilled Gray Iron.
Stock Removed, .030″ Diameter.



Grinding Time 10 Minutes.
Material, Chilled Gray Iron.
Stock Removed, .018″ Diameter.



Grinding Time 1½ Hours.
Material, Chilled Gray Iron.
Stock Removed, .030″ Diameter.

Grinding Chilled Iron Rolls On A Landis Grinder

In the machining of chilled iron rolls the common method has been to finish them by turning—

Which has always been unsatisfactory. Just how inferior and inaccurate turned rolls are was never found out until the rolls were finished by grinding. Then they were round, straight and also had a high finish.

In grinding rolls, some of which weigh five and six tons, and more, it is first imperative that the roll be given a *solid* foundation.

By this is meant that not only should the machine have a solid foundation, but the roll itself should be made more solid by reason of its *not having any longitudinal* movement.

This means, in fact, that the roll being ground should be a part of the machine—

The heavier the work the more important it is that the wheel be traversed and the work be kept stationary and solid. It would require from five to ten times the power to put a roll in motion that would be required to revolve it. And furthermore, if the roll were traversed, an unequal strain would come on the reversing mechanism, besides having varied weights upon the work table bearings.

The only correct way to carry the roll is to run it on its bearings, or necks, which will produce a finished roll with the face concentric with the bearings.

These correct principles have all been followed out in Landis Grinders. The examples of work testify as to the *results*. Write for catalog and further data.

Landis Tool Company
Waynesboro, Pa., U. S. A.

INCREASED OUTPUT—REDUCED COST

Grinders, Tool—*Continued.*
Niles-Bement-Pond Co., 3, 43 to 47 and 79
Norton Grinding Co. 68
Oesterlein Mach. Co. 30
Pratt & Whitney Co. 2 and 48
Ransom Mfg. Co. 115
Rivett Lathe Mfg. Co. 135
Rockford Drilling Mach. Co. 131
Rowbottom Machine Co. 117
Safety Emery Wheel Co. 117
Sellers & Co., Wm. 36
Standard Tool Co. 26
Tabor Mfg. Co. 99
U. S. Electrical Tool Co. 114
Vandyck Churchill Co. 103
Vitrified Wheel Co. 117
Walker & Co., O. S. 136
Wells & Son Co., F. E. 116
Whitney Mfg. Co. 53
Wilmarth & Morman Co. 116

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American Emery Wheel Wks. 117
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Besly & Co., Chas. H. 85
Blake & Johnson Co. 116
Blanchard Mach. Co. 94 and 127
Blount Co., J. G. 117
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Coates Clipper Mfg. Co. 128
Gardner Machine Co. 116
Grant Mfg. & Mach. Co. 90
Greenfield Machine Co. 116
Harrington, Son & Co., Edwin. 89
Holtzer-Cabot Electric Co. 120
Landis Tool Co. 57
Leland & Co., W. H. 123
McCabe, J. J. 78 and 88
Newton Machine Tool Wks. 19
Niles-Bement-Pond Co., 3, 43 to 47 and 79
Norton Grinding Co. 68
Ransom Mfg. Co. 1 5
Rivett Lathe Mfg. Co. 135
Rowbottom Machine Co. 117
Safety Emery Wheel Co. 117
Springfield Mfg. Co. 126
Sterling Emery Wheel Mfg. Co. 116
U. S. Electrical Tool Co. 114
Vitrified Wheel Co. 117
Wells & Son Co., F. E. 116

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Diamond Machine Co. 129
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Niles-Bement-Pond Co., 3, 43 to 47 and 79
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Springfield Mfg. Co. 126
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Reed Co., F. E. 38

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Hammers, Belt Driven
Nazel Engr. Machine Works. 109
Prentiss Tool & Supply Co. 78

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Bliss Co., E. W. 61
Bradley & Son, C. C. 109
Gould & Eberhardt 35
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Prentiss Tool & Supply Co. 78
Toledo Mach. & Tool Co. 109
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Bliss Co., E. W. 61
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Dallett Co., Thos. H. 105
Independent Pneu. Tool Co. 105
Ingersoll-Rand Co. 105
Niles-Bement-Pond Co., 3, 43 to 47 and 79
Sellers & Co., Wm. 36

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Bradley & Son, C. C. 10

Hammers, Steam
Bradley & Son, C. C. 109
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Niles-Bement-Pond Co., 3, 43 to 47 and 79
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Osgood, J. L. 121
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Hangers, Shafting
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Hess-Bright Mfg. Co. 84
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Adams Co. 114
Brown & Sharpe Mfg. Co., 55 and 136
Meisselbach-Catucci Mfg. Co. 113
Newark Gear Cutting Machine Co. 114
Newton Machine Tool Wks. 19
Pratt & Whitney Co. 2 and 48
Schuchardt & Schütte. 83 and 126

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Caldwell & Sons Co., H. W. 95
Link-Belt Co. 75
Niles-Bement-Pond Co., 3, 43 to 47 and 79
United Engr. & Fdry. Co. 109
Yale & Towne Mfg. Co. 110

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Maris Bros. 110
Niles-Bement-Pond Co., 3, 43 to 47 and 79
Northern Engineering Wks. 110
Shaw Electric Crane Co. 110
Shepard Electric Crane and Hoist Co. 110
Sprague Electric Co. 119
Westinghouse Elec. & Mfg. Co. 119
Yale & Towne Mfg. Co. 110

Hoists, Hand
Harrington, Son & Co., Edwin. 89
Moore Co., Franklin. 110
Niles-Bement-Pond Co., 3, 43 to 47 and 79
Yale & Towne Mfg. Co. 110

Hoists, Pneumatic
Chicago Pneumatic Tool Co. 104
Independent Pneu. Tool Co. 105
Ingersoll-Rand Co. 105
Northern Engineering Wks. 110
Shepard Electric Crane and Hoist Co. 110

Hones
Carborundum Co. 28

Hose
Chicago Pneumatic Tool Co. 104
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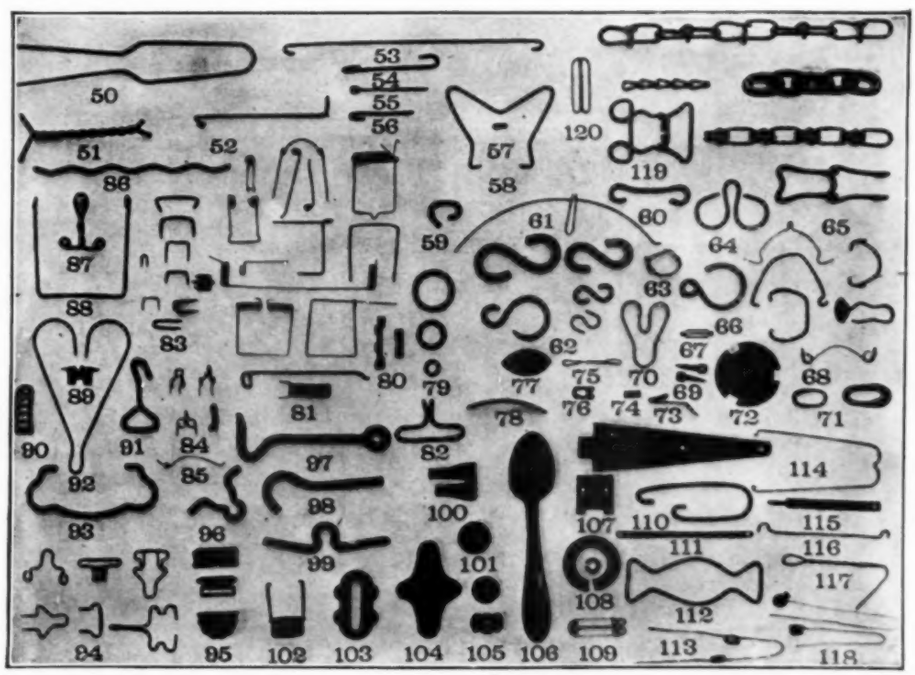

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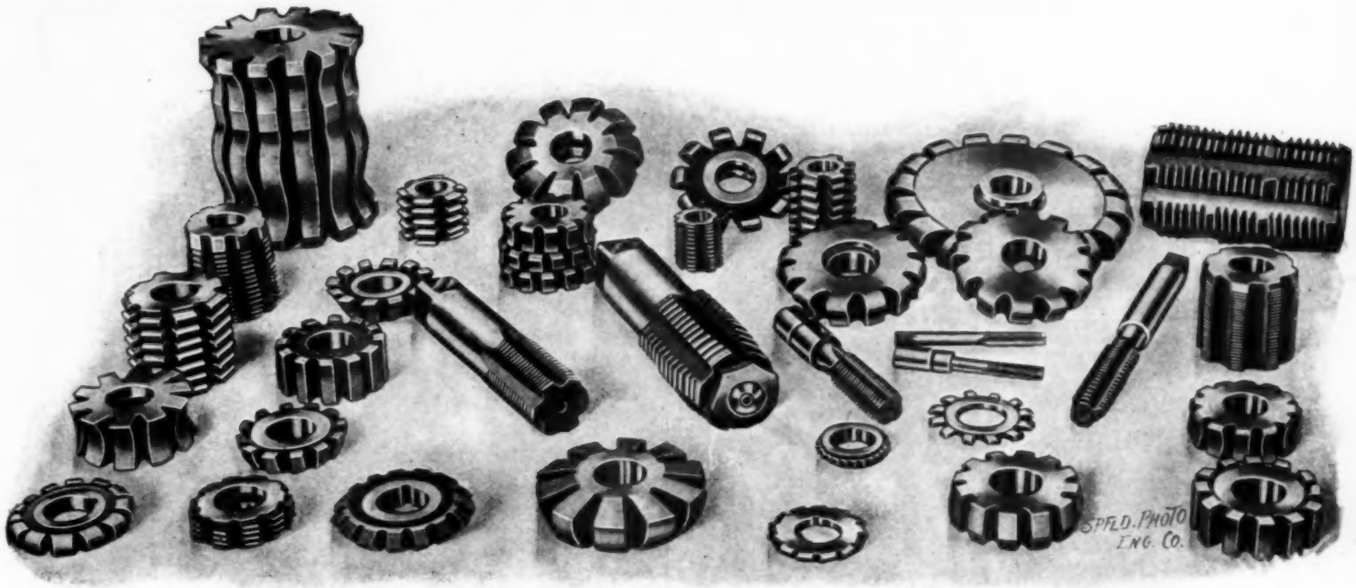

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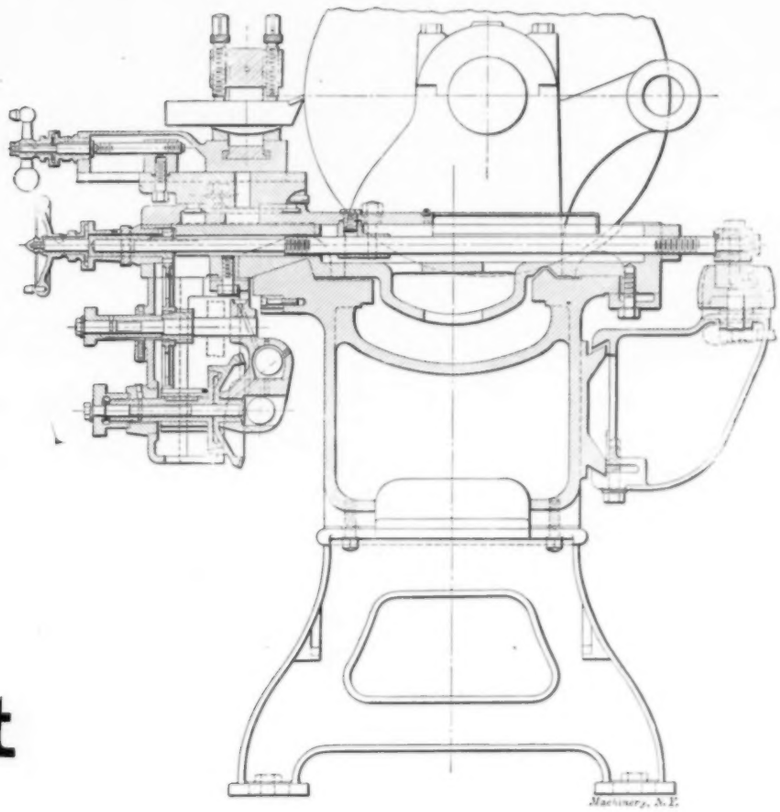
The LE BLOND Tool Support



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This is the result of poor tool support, caused by the tool overhanging the bed.

The tool never overhangs the bed on our Heavy Duty Lathes even when working at the maximum swing.

This means the same efficient feed and speed on the large diameters, and the resulting reduction in cost.

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